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Pneumonia Complicated by Lung Abscess and Pleural Effusion. Case Report and Review of the Literature

Neumonía Complicada por AbscesoPulmonar y Derrame Pleural. Presentación de un caso y revisión de la literatura

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Summary

Pneumonia is an acute lung infection that can lead to serious complications, such as lung abscesses and pleural effusions. It is estimated to account for 15% of hospitalizations in children under 5 years of age, and complications occur in 5–10% of cases. In this context, we present the clinical case of a 5-year-old patient with cough, high fever, and respiratory distress, supported by clinical and laboratory criteria confirming the diagnosis of complicated pneumonia. Furthermore, we review the literature on the disease, its complications, diagnosis, and treatment, emphasizing that proper detection and management are crucial to reduce the incidence of complications and promote effective recovery. This case underscores the complexity of managing complicated pneumonia in pediatrics, where surgical intervention was essential. Multidisciplinary follow-up facilitated recovery, highlighting the importance of early diagnosis and appropriate treatment.
Keywords: complicated pneumonia, lung abscess, pleural effusion, surgical intervention, multidisciplinary treatment, diagnosis.

Resumen

La neumonía es una infección pulmonar aguda que puede provocar complicaciones graves, como abscesos pulmonares y derrames pleurales. Se estima que es responsable del 15% de las hospitalizaciones en niños menores de 5 años, y las complicaciones ocurren en el 5-10% de los casos. En este contexto, se presenta el caso clínico de un paciente de 5 años con tos, fiebre alta y dificultad respiratoria, respaldado por criterios clínicos y de laboratorio que confirman el diagnóstico de neumonía complicada. Además, se revisa la literatura sobre la enfermedad, sus complicaciones, diagnóstico y tratamiento, enfatizando que la detección y el manejo adecuados son cruciales para disminuir la incidencia de complicaciones y favorecer una recuperación efectiva. Este caso subraya la complejidad del manejo de la neumonía complicada en pediatría, donde la intervención quirúrgica fue fundamental. El seguimiento multidisciplinario facilitó la recuperación, resaltando la importancia del diagnóstico temprano y un tratamiento adecuado.
Palabras clave: neumonía complicada, absceso pulmonar, derrame pleural, intervención quirúrgica, tratamiento multidisciplinario, diagnóstico.

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1. Introduction

Pneumonia is an acute infection of the pulmonary parenchyma that can be caused by various pathogens, including bacteria, viruses, and fungi. This disease represents one of the leading causes of morbidity and mortality in the pediatric population worldwide. According to the World Health Organization (WHO), pneumonia is responsible for approximately 1.5 million deaths annually in children under five years of age, which underscores the importance of its prevention and appropriate treatment [1]. The clinical presentation of pneumonia can vary from mild forms, which are managed as an outpatient, to severe forms requiring hospitalization and intensive care.

The prevalence of pneumonia varies significantly by geographic region, socioeconomic status, and patient age. A study by Liu et al. (2019) reported that the prevalence of pneumonia in children under five years of age in developing countries is approximately 20% to 30%, while in developed countries, the figure is considerably lower, around 5% [2]. This disparity highlights the need for targeted interventions in vulnerable populations and access to adequate medical care.

Complications associated with pneumonia, such as pleural effusion and lung abscess, are of particular concern in pediatric management. These complications may arise due to inflammation and fluid accumulation in the pleural cavity, which may require invasive procedures such as thoracentesis or video-assisted thoracoscopy for resolution [3]. Pneumonia is the leading cause of pleural effusion (PE) in children, and approximately 20–40% of children present with it. Early identification of these complications is crucial to improve clinical outcomes and reduce associated mortality.

Research in the field of pneumonia has advanced in recent decades, with an increasing focus on identifying risk factors, improving treatment strategies, and implementing vaccination programs. The introduction of

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pneumococcal and influenza vaccines has proven effective in reducing the incidence of pneumonia in the pediatric population [4]. However, despite these advances, pneumonia remains a significant public health challenge, especially in contexts of poverty and lack of access to health care.

The objective of this research is to describe a clinical case of pneumonia with complications, specifically associated with the presence of pleural effusion, addressing the clinical characteristics, diagnostic methods used, patient evolution and therapeutic interventions performed for its comprehensive management.

2. Clinical case

A 5-year-old male patient, with vaccinations up to one year of age in his card, reports incomplete and pending Chickenpox (15 months) and DPT at 18 months (first booster), as a significant history of hospitalization in another health center for 5 days due to respiratory failure, accompanied by a wet cough, emetizing on one occasion with food content. During this hospitalization, he presented with a high-grade fever of 39.9 ° C that partially responded to antipyretics, he began with respiratory difficulty characterized by tachypnea, as there was no improvement in the family, he requested voluntary discharge and came to our health center on their own.

On arrival, with support of a non-rebreathing mask, he appears dehydrated with a pale appearance. Cardiorespiratory examination shows nasal flaring, tachycardic, tachypneic, in (p90-99) for his age. On auscultation, regular air entry, hypoventilation in the left lung, he presents respiratory difficulty, prolonged capillary refill of 4 seconds, temperature of 37.3 ° C and persistent cough. Evaluated with a Wood Downes Score of 6p - Moderate.

Among our first interventions, oxygen was placed by AF 16 Liters with FiO2 50%. Among the laboratory tests, a complete blood count

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showed leukocytosis 22,800 associated with neutrophilia and a CRP 268 in the context of clinical symptoms with PEWS assessment of 4 points, and it was decided to hospitalize and expand the studies.

A chest X-ray was performed, which showed left basal radiopacity with blurring of the left costodiaphragmatic angle, and a chest computed tomography with a pulmonary window showed or showed a lung abscess in the lower lobe and free fluid in the left pleura. Evaluated by the infectious disease service, who initially prescribed IV Ceftriaxone 75 mg/kg/day every 24 hours and IV Clindamycin 40 mg/kg/day every 6 hours. Serological studies included blood cultures and urine culture, without bacterial growth, swabs for viral uptake upon admission for RSV, and PCR for COVID, which were negative.

The patient remains in regular clinical condition with oxygen support via a high-flow nasal cannula. He persists with respiratory difficulty and is reassessed with a 3-point Wood Downes test. He was evaluated by the pediatric surgery service, who reported that the patient required surgical treatment. Prior to improving hemodynamics, a red blood cell transfusion was indicated due to a hemoglobin level of 8.4 and a hematocrit of 24.2. He was scheduled for diagnostic video-assisted thoracoscopy + pulmonary decortication with fibrin removal + placement of a left chest tube + placement of a left subclavian central venous catheter. The findings were: Pachypleuritis, multiple fibrin collections, abscess in the lower lobe, lateral basal segment, and free fluid in the pleura of 50cc. 5 days after his first intervention, he was scheduled with the pediatric surgery service for a left lower lobectomy + pleural cavity lavage + chest tube placement + pleurovac change. Findings: Cavitary lesion with necrosis and abundant fibrin involving the left lower lobe. The following studies were performed as part of the approach:

1. Pleural fluid: Cytological - cytochemical: cloudy appearance, leukocytes 0.721, 10 ´3/ul polymorphonuclear 89.8%, glucose 7.42, proteins 5.19 g/dl, LDH 5215 U/L, rivalta negative

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2. Gram stain and Ziehl stain, culture and PCR/Tb DNA of pleural fluid: negative.
3. Gram stain, Ziehl stain, culture and PCR/Tb DNA of gastric aspirate: negative.

Approached in intermediate care in the context of his clinical picture, he is considered to have complicated pneumonia, with findings of an abscess in the left lung, tuberculosis has already been ruled out. His antimicrobial coverage should be directed especially at Gram-positive germs: Streptococcus pneumoniae, S. aureus. The infectious disease service suggests management with Ceftriaxone and vancomycin for 21 days. Intravenous antibiotic treatment is prescribed with Ceftriaxone 75 mg/kg/day IV every 24 hours and Vancomycin 40 mg/kg/day IV every 6 hours, completing the regimen for 21 days.

Furthermore, during hospitalization, on day 14, the patient developed a clinical picture with suspected viral infection accompanied by abundant hyaline rhinorrhea. A swab for respiratory virus was requested, which was positive for parainfluenza 1. His management was symptomatic.

His evolution was favorable, before being discharged he was found hemodynamically stable, neurologically alert, mobility preserved, connected, with no signs of respiratory distress, right lung field well ventilated, left lung field slightly hypoventilated, chest tube wound healed, he performed respiratory exercises with triflow (respiratory incentive spirometer) every 4 hours, with adequate oral tolerance, without signs of abdominal alarm, having control analysis leukocytes: 6.78 with neutrophils: 41, lymphocytes: 39, hemoglobin: 11.7, hematocrit: 33.8, platelets: 447, CRP: 3.69. Biopsy: Leukocyte fibrin exudate devoid of stroma. No granulomas or pathogenic microorganisms were identified. Control echocardiogram reported as normal, without pericardial effusion. Patient did not present fever peaks and showed improvement in respiratory distress. The patient was kept under surveillance and discharge was scheduled with instructions for outpatient follow-up, follow-up by specialists, and the recommendation to complete the pending vaccination schedule.

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1.1 Figures, Tables and Diagrams

Table 1.

Auxiliary examinations performed on the patient

Laboratory Tests	Results	Reference Value
Blood Count	Leukocytes: 22,800 /uL	4,000 - 10,000 /uL
	Neutrophils: 76.1%	40% - 75%
	Lymphocytes: 12.3%	20% - 45%
	Hemoglobin: 8.4 g/dL	11.5 - 15.5 g/dL
	Hematocrit: 24.2%	34% - 44%
	Platelets: 750,000 /mm³	150,000 - 450,000 /mm³
	CRP: 268 mg/dL	< 5 mg/dL
	PCT: 1.13 mg/dL	< 0.5 mg/dL
Blood Count (Control)	Leukocytes: 6,780 /uL	4,000 - 10,000 /uL
	Neutrophils: 41%	40% - 75%
	Lymphocytes: 39%	20% - 45%
	Hemoglobin: 11.7 g/dL	11.5 - 15.5 g/dL
	Hematocrit: 33.8%	34% - 44%
	Platelets: 447,000 /mm³	150,000 - 450,000 /mm³
	PCR: 3.69 mg/Dl	< 5 mg/dL
Blood Culture	No growth	-
Urine Culture	No growth	-
Tuberculosis Studies	Non-reactive	-
Swabs for RSV and COVID PCR	Negatives	-
Swab for Influenza Type I	Positive	-
Echocardiogram	Normal, without pericardial effusion	-
Catheter Culture	No bacterial growth	-
Catheter Gram	No growth	-
Biopsy	Leukocyte fibrin exudate, without granulomas or pathogenic microorganisms	-

Source: Prepared by the author

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Figure 1. Chest X-ray with condensation image in the left hemithorax, area of alveolar infiltrate with blurring of the left costodiaphragmatic and cardiophrenic angle

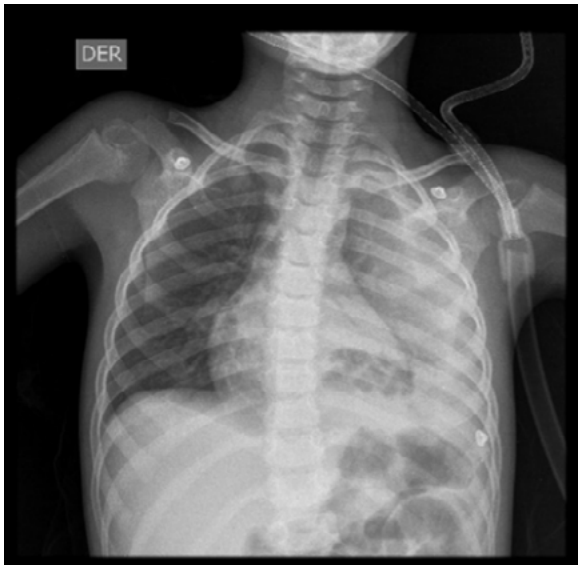

Figure 2. Lung window computed tomography showing a left lower lobe lung abscess with a thick-walled cavity and air-fluid level.

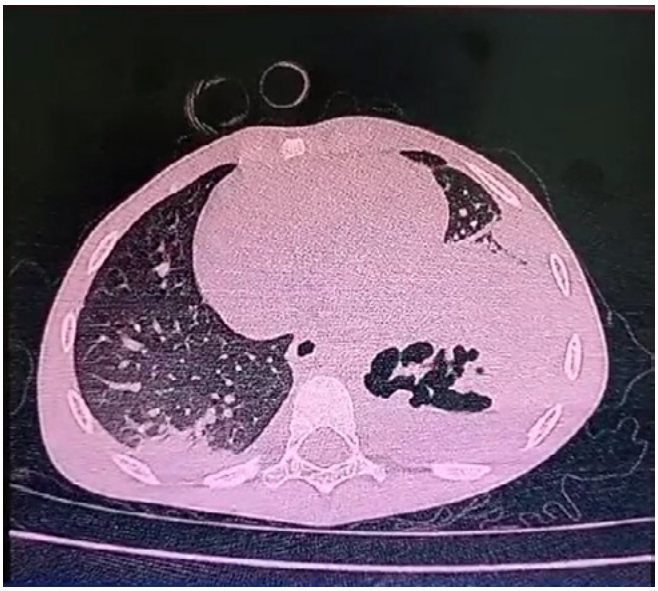

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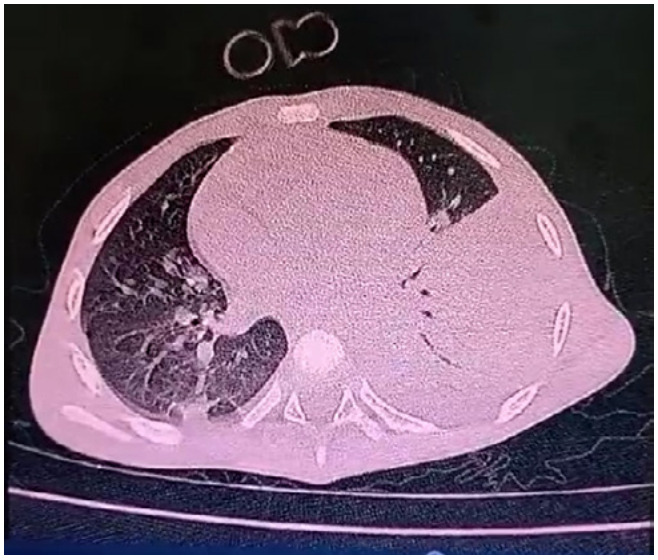
Figure 3. Computed tomography in the pulmonary window showing a left pleural effusion, evidenced by the accumulation of fluid in the pleural space, partially displacing the pulmonary structures.



3. Discussion

The case presented describes a 5-year-old male patient with a complex clinical presentation including complicated pneumonia, pleural effusion, and lung abscess. This type of presentation is relatively common in pediatrics, especially in children with a history of previous respiratory infections. According to a recent study, respiratory infections are a leading cause of morbidity and mortality in children, and complicated pneumonia can result in hospitalization and intensive treatment [5].

The patient's clinical history, which includes high fever, cough, and shortness of breath, is indicative of a severe respiratory infection requiring immediate medical attention. The progression of symptoms from a dry cough to a wet cough, accompanied by vomiting and high fever, is a pattern that may indicate progression of the disease to complicated pneumonia [6]. Identification of symptoms such as tachypnea and

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shortness of breath are criteria for severity that warrant hospitalization and intensive management [7].

The patient had an incomplete vaccination schedule for his age, with a valid vaccination card showing that he was still due for chickenpox (15 months) and DPT at 18 months (first booster), which is a negative aspect in his medical history. Vaccination is essential to prevent severe infections, as it reduces the incidence of pathogens such as Streptococcus pneumoniae and Haemophilus influenzae, which are common germs that cause pneumonia in this age group [8]. However, his previous hospitalization for respiratory failure suggests an underlying vulnerability to respiratory infections. It is important to note that, although vaccination decreases the risk of pneumonia, it does not completely eliminate it, especially in children with underlying conditions.

The decision was made to hospitalize the patient due to his symptoms, which presented a high risk of decompensation. Considering the clinical features, risk factors, and laboratory results, such as leukocytosis and elevated CRP, which are markers of inflammation and infection, it was decided to initiate empirical antimicrobial therapy due to the suspicion of involvement of the most common bacterial infectious agents in our community, such as Streptococcus pneumoniae, Staphylococcus aureus, and Haemophilus influenzae. Leukocytosis and elevated acute-phase reactants are common indicators of bacterial infection and support the decision to initiate antibiotic treatment. The CT report confirmed the presence of complications associated with pneumonia, such as lung abscesses, which can arise in the context of an untreated or poorly managed infection. These complications, together with the time of disease progression, justify the urgent need for appropriate antibiotic treatment to prevent further deterioration in the patient's health. Furthermore, it has been documented that viral infections can predispose to bacterial superinfections, which is increasingly common in clinical practice [9]. Chest X-ray and CT confirmed the presence of a lung abscess and pleural

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fluid, justifying subsequent surgical intervention, considering that these abscesses can develop between 1 to 3 weeks after a lung infection [10].

Video-assisted thoracoscopy and subsequent lobectomy are justified procedures in cases of complicated lung abscesses, especially when there is significant involvement of the lung parenchyma. Surgical intervention is often necessary to drain abscesses and improve pulmonary ventilation [11]. Fibrin removal and pleural fluid management are crucial to prevent further complications and improve respiratory function, especially in cases where the lung abscess is large (usually larger than 5 cm), presents significant clinical symptoms such as respiratory distress, persistent fever or productive cough with purulent sputum, or does not respond to adequate medical treatment after 48–72 hours. Furthermore, drainage is indicated in the presence of significant pleural effusion or empyema, as well as in patients with comorbid conditions that may complicate recovery. The Wood-Downes scale modified by Ferrés is an essential clinical tool to assess the severity of respiratory distress in pediatric patients with complicated pneumonia. This scale considers parameters such as respiratory rate, accessory muscle use, tachypnea, cyanosis, and abnormal breath sounds, allowing the classification of symptom severity and guiding rapid therapeutic decisions. The application of this scale would be crucial in determining the need for more intensive interventions, such as respiratory support or surgery. Evaluation with this scale helps tailor clinical management and guide decisions regarding antimicrobial treatment and possible surgical interventions, ensuring appropriate care. [12]. Radiological evaluation showing an abscess that does not resolve with medical treatment also warrants intervention, and consultation with pediatric surgery or pulmonology specialists is recommended to determine the most appropriate drainage method. [13].

The administered antibiotic treatment, which included ceftriaxone and vancomycin, is adequate to cover a wide range of pathogens, including those commonly associated with complicated respiratory tract

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infections. This regimen is justified by the presence of germs frequently detected in different age groups, such as Streptococcus pneumoniae and Staphylococcus aureus (including methicillin-resistant strains - MRSA), and that is why this regimen was chosen, since these pathogens are relevant in the pediatric population and can contribute to the severity of infections. [14]. The treatment duration of 21 days is consistent with the guidelines for the management of complicated pneumonias in pediatrics, reinforcing the importance of an aggressive approach in the treatment of these infections. Although shorter courses may be appropriate in certain situations, in the context of complicated pneumonias, conventional therapy remains the preferred option to ensure complete eradication and prevent complications [15].

It is essential to emphasize the importance of not self-medicating, as this can hamper bacterial isolation in cultures and complicate infection management [16]. Patient progress to a hemodynamically stable state without respiratory distress at discharge is a positive indicator of treatment effectiveness. Normalization of hematologic parameters and absence of bacterial growth in cultures are also encouraging signs suggesting resolution of the infection.

4. Conclusions

This case highlights the complexity of managing complicated pneumonia in children, where early identification and appropriate treatment are essential to improve outcomes. Furthermore, vaccination against Streptococcus pneumoniae is crucial to prevent pneumonia and other related infections in children under 5 years of age. In Ecuador, the implementation of the pneumococcal conjugate vaccine (PCV10) in 2011 and the use of PCV13 in the private sector since 2010 have improved coverage against the most common serotypes. PCV10 protects against

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33.3% of the serotypes identified in this population, while PCV13 covers 66.6%, highlighting its superior efficacy compared to local epidemiology. However, the emergence of serotypes such as 19A and 15A, which are not included in PCV10, indicates the need to adjust vaccination strategies for better prevention. It is crucial to continue monitoring the predominant serotypes through epidemiological reports such as those from SIREVA II, which will allow for the adaptation of immunization policies and strengthen the protection of children in Ecuador. This will provide a protective factor in preventing severe respiratory infections in the pediatric population.

5. Abbreviations

WHO: World Health Organization
DP: Pleural Drainage
PCR: C-reactive protein
DPT: Diphtheria, Pertussis, and Tetanus
KG: Kilograms
IV: Intravenous
DNA: Deoxyribonucleic Acid
TB: Tuberculosis
ATB: Antibiotics
LDH: Lactate Dehydrogenase
AF: High Flow
FIO2: Fraction of Inspired Oxygen
PEWS: Pediatric Early Warning Score
RSV: Respiratory Syncytial Virus
PCV10: 10-Valent Pneumococcal Conjugate Vaccine
PCV13: 13-Valent Pneumococcal Conjugate Vaccine
SIREVA II: Bacterial Resistance Surveillance System

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6. Contribution of the authors

First author initials: Data collection, case description, literature and analysis.

Second author initials: Systematic review and case discussion

Third author initials: Final case review and updated literature contribution

Fourth author initials: Initial corrections, figures and tables

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