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Ultrasound Value in the Management of Parapneumonic Pleural Effusions in a Limited-Resource Setting: A Case Report

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Abstract

Pleural effusion is a common complication of acute lung infection, with rising morbidity and mortality. If poorly treated, parapneumonic effusion evolves to the fibrino-purulent stage wherein antibiotic therapy alone becomes inadequate. Chest CT is the gold standard diagnostic imaging tool, however, in a resource-limited context, it may not be performed. Chest ultrasound can therefore be an alternative for drainage and intermittent follow-up of complicated parapneumonic pleural effusions. We report the case of a 4-year-old child who presented with cough, breathing difficulties and fever for over two weeks and in whom an initial chest X-ray revealed a left hemithorax white-out with an air-fluid level. Chest ultrasound revealed a left pleuropulmonary massive fluid collection with an encysted empyema. It also allowed ultrasound-guided pleural effusion drainage of a fibrino-purulent liquid which tested positive for *Kocuria kristinae,* a bacterium sensitive to gentamycin, vancomycin, norfloxacin and clindamycin. The next follow-up ultrasound checks showed improvement and the control chest X-ray performed one month later demonstrated pulmonary functional recovery. This case highlights the importance of ultrasound in the management and follow-up of this chest pathology in resource-limited settings.

Keywords

Chest Ultrasound, Ultrasound-Guided Pleural Puncture, Parapneumonic Effusion

1. Introduction

Parapneumonic pleural effusion (PPE) is a common complication of acute lung infection and is the main cause of infectious pleurisy, accounting for 55% - 73% of cases with an increasing morbidity and mortality [1]. Although termed as "para-pneumonic", the microbial epidemiology is different from that of pneumonia with a greater frequency of anaerobes in PPE. PPE could evolve in 3 stages which are: exudative, fibrino-purulent and organized. Such progression could be the result of an inadequate treatment or an imbalance between microbial virulence and host immune defenses. A fibrino-purulent PPE is said to be "complicated" when antibiotic therapy alone proves inadequate to resolve it. An exploratory pleural puncture is usually the central diagnostic step that distinguishes a complicated from an uncomplicated PPE. Indeed, complicated PPE requires evacuative treatment through repeated pleural evacuative punctures, pleural drainage or a more invasive procedure such as surgery [1] [2]. Chest X-ray and CT scan are respectively the first-line and the gold standard imaging tools in these situations. However, they may be associated with excessive irradiation, especially if there is a need for repetition during follow-up. Moreover, in our context where patients and their families have to finance their work-ups, the sustainability of diagnosis and monitoring is often compromised. Chest ultrasound can therefore be an alternative tool for the assessment, drainage and follow-up of complicated PPE [3]. The aim of this case report was to highlight the importance of ultrasound in the management and follow-up of parapneumonic pleural effusions in a poor socio-economic setting.

2. Case Presentation

It is the case of a 4-year-old male child, 25 kgs, admitted to hospital in November 2022 for breathing difficulties, a non-productive wet cough and fever evolving over a 2 weeks period. Upon admission, he presented with a good hydration status but a poor general state characterized by asthenia and anorexia. His hemoglobin concentration was at 10.1g/dL, peripheral oxygen saturation (SpO2) ranged between 86% and 91%. The initial chest X-ray revealed a left hemithorax white-out (**Figure 1(a)**). Antibiotic therapy (intravenous ceftriaxone) was administered for over two weeks. The evolution was marked by a persistent intermittent fever (38˚C - 40˚C) and the worsening of breathing difficulties which prompted a control chest X-ray. The film revealed an air-fluid level within the left hemithorax white-out (**Figure 1(b)**).

A chest CT scan was requested but not done, due to financial constraints. A chest ultrasound scan was therefore the alternative imaging modality for assessment. In addition to the left pleuropulmonary fluid collection which was an encysted empyema, there was an associated left lung consolidation (**Figure 1(c)**). With the clinical and radiological features of extensive pneumonitis associated with an abundant encysted PPE, an ultrasound-guided drainage was done and 150 ml of fibrino-purulent fluid was evacuated. This fluid tested positive for

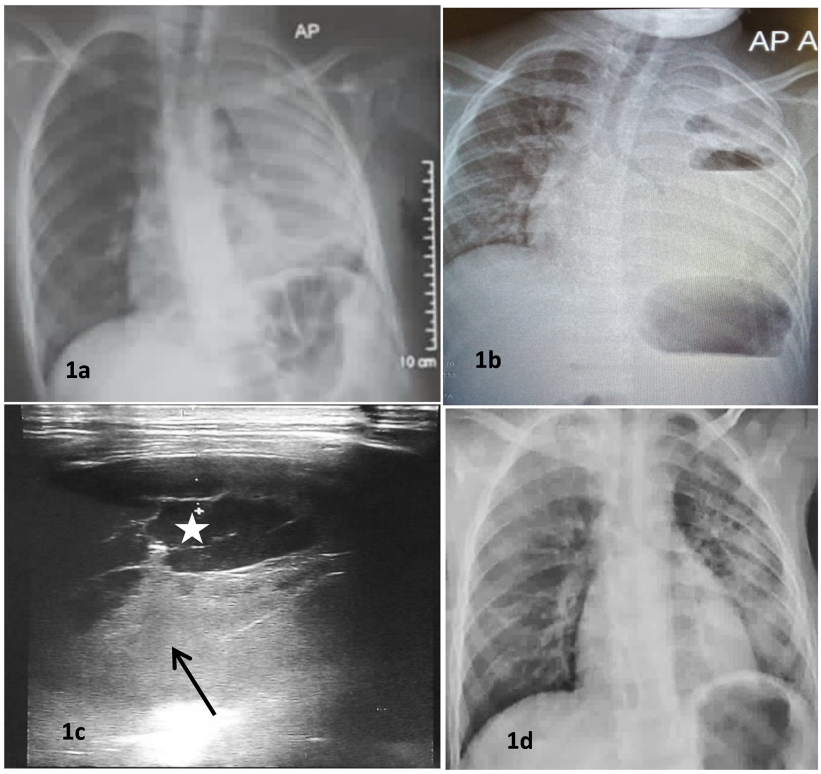

Figure 1. The three X-rays performed and the pleuropulmonary ultrasound. The initial image (1a) revealed an almost complete left lung white-out. After 2 weeks of broad-spectrum antibiotic therapy with no favourable follow-up, the control image (1b) showed the appearance of an air-fluid level within the left lung white-out. The post-therapeutic evaluation X-ray at one month showed a resumption of pulmonary aeration (1d). On pleuropulmonary ultrasound (1c), there was a parapneumonic pleural effusion (white star) associated with contiguous pulmonary consolidation (black arrow).

Kocuria kristinae, a bacterium sensitive to gentamycin, vancomycin, norfloxacin and clindamycin, without evidence of tuberculosis bacilli. Antibiotic therapy with vancomycin and gentamycin was initiated in addition to oxygen therapy at 2 liters per minute, expectorants and antipyretics.

His evolution showed marked improvement, characterized by improved lung function without fever. Follow-up chest ultrasound scans showed regressing pleural effusion. The final chest X-ray done in December 2022, a month later, showed improved pulmonary aeration (**Figure 1(d)**). The patient was discharged from hospital and placed on ambulatory chest physiotherapy which consisted of deep breathing exercises and coughing.

3. Discussion

Infectious pleuropneumonia in children is common. It is usually due to the invasion of the pleural space by pathogens from a contiguous parenchymal infection thereby referred to as PPE [2] [4]. Several epidemiological studies show a rising incidence of PPE and empyema over the past two decades, even after age adjustments [1]. PPE is therefore the most common cause of exudative pleural

effusion, affecting patients at all ages, most especially the pediatric population [5].

At the parapneumonic infection state, the bacterial epidemiology of infectious pleurisy is often different from that of infectious pneumonitis. In our case, we found anaerobic pathogens. This could be partly explained by the acidity and hypoxia of the infected pleural fluid which promotes the growth of anaerobes [6] [7]. Exploratory pleural puncture is an essential step in the diagnosis, pathogen identification and classification of PPE into two groups hence, guiding therapeutic management: uncomplicated PPE and complicated PPE or empyema. In complicated PPE as in our case, sepsis and parenchymal destruction can be life-threatening. In 2000, the American College of Chest Physicians (ACCP) proposed a simple classification based on both imaging and pleural fluid analysis, allowing for the stratification of PPE into four categories [7]. In all cases, empirical antibiotic therapy must be started early, at best from the stage of pneumonitis as in our case. If appropriate and well adapted, it is often sufficient for the management of an early-seen pneumonitis, which prevents the development of pleural effusion or prevents the progression of an uncomplicated PPE effusion to purulence. Without appropriate treatment, the prognosis is poor with an estimated mortality rate of 5% - 30% [1] [6] [7].

Standard radiological diagnostic techniques such as chest X-ray and CT scans are not without risk, especially when they have to be repeated during follow-up [8]. Moreover, in our milieu where patients and their families have to finance their medical procedures, the sustainability of diagnosis and monitoring is often compromised. Therefore, ultrasound which is more accessible, cheap and non-irradiating, becomes "the poor man's scanner", a real alternative for the evaluation, drainage and monitoring of complicated PPE in our setting.

4. Conclusion

The relevance of this case was to practically demonstrate the role of chest ultrasound in the management of a patient with complicated PPE in a resource-limited setting plagued with high mortality among such cases. This imaging procedure, in a setting as ours, remains clinically efficient and cost-effective and should therefore be considered, in the management of patients with complicated PPE.

Conflicts of Interest and Ethical Consideration

The authors declare no conflicts of interest in relation with this article.

In accordance with the declaration of Helsinki and the guidelines of good clinical practice issued by the International Conference on Harmonization (ICH), the informed consent was obtained from patient's father to report this case.

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