

Epidemiological, Etiological, Clinical, and Therapeutic Aspects of Pleural Effusion in Children at the Pediatric Department of Libreville University Hospital

ABSTRACT

OBJECTIVE:

THIS STUDY AIMED TO IMPROVE THE MANAGEMENT OF PEDIATRIC PLEURAL EFFUSION AT LIBREVILLE UNIVERSITY HOSPITAL BY IDENTIFYING PRIMARY ETIOLOGIES AND PROPOSING EFFECTIVE DIAGNOSTIC AND THERAPEUTIC STRATEGIES.

METHODS

A RETROSPECTIVE, DESCRIPTIVE, AND ANALYTICAL STUDY WAS CONDUCTED FROM JANUARY 2017 TO APRIL 2020, INCLUDING 59 CHILDREN AGED 1 MONTH TO 16 YEARS HOSPITALIZED FOR PLEURAL EFFUSION. DATA WERE ANALYZED USING EPI-INFO 7 SOFTWARE. INCOMPLETE RECORDS AND NON-PLEURAL EFFUSION CASES WERE EXCLUDED.

RESULTS

THE PREVALENCE OF PEDIATRIC PLEURAL EFFUSION WAS 0.47%, WITH A MALE PREDOMINANCE (54.2%) AND A PEAK AGE RANGE OF 1–5 YEARS (50.8%). COMMON SYMPTOMS INCLUDED FEVER, COUGH, AND RESPIRATORY DISTRESS. THE MOST FREQUENT ETIOLOGIES WERE *STAPHYLOCOCCUS AUREUS* (26%) AND PLEUROPULMONARY TUBERCULOSIS CONFIRMED BY GENEXPERT (13.6%). CHEST RADIOGRAPHS SHOWED UNILATERAL EFFUSION IN 89.7% OF CASES, WHILE PLEURAL ULTRASOUNDS, PERFORMED IN 62.7% OF PATIENTS, CONFIRMED EFFUSION IN 60.5%. EMPIRICAL ANTIBIOTIC THERAPY WAS ADMINISTERED INITIALLY AND LATER ADJUSTED BASED ON ANTIBIOGRAMS. PATIENTS DIAGNOSED WITH TUBERCULOSIS RECEIVED A STANDARD ANTITUBERCULAR REGIMEN, INCLUDING RIFAMPICIN, ISONIAZID, PYRAZINAMIDE, AND ETHAMBUTOL. THE AVERAGE HOSPITAL STAY WAS 21.6 DAYS, AND OUTCOMES WERE GENERALLY FAVORABLE.

CONCLUSION

PEDIATRIC PLEURAL EFFUSION IS UNCOMMON IN GABON, BUT PLEUROPULMONARY TUBERCULOSIS REMAINS A SIGNIFICANT CAUSE. EARLY DIAGNOSIS AND PROMPT TREATMENT, INCLUDING APPROPRIATE ANTIMICROBIAL THERAPY AND STANDARDIZED ANTITUBERCULAR REGIMENS, ARE ESSENTIAL TO IMPROVING OUTCOMES.

Keywords: pleural effusion , Staphylococcus aureus, tuberculosis, diagnosis, treatment, drainage

1. INTRODUCTION

Pleural effusion, the accumulation of fluid in the pleural cavity, is a significant pediatric condition associated with considerable morbidity and mortality [1, 2]. In sub-Saharan Africa, its increasing prevalence is linked to factors such as antibiotic resistance and limited access to healthcare [3, 4]. Despite advancements in diagnostic and therapeutic methods, data specific to Gabon remain sparse, making studies necessary to guide evidence-based management.

The objective of this study was to improve the management of pediatric pleural effusion cases at Libreville University Hospital by identifying common etiologies and proposing effective strategies.

1. Objective

To contribute to improving the management of children hospitalized for pleurisy at the University Hospital Center of Libreville (CHUL).

2. MATERIAL AND METHODS

Study Design and Period: This is a retrospective, descriptive, and analytical study conducted between January 2017 and April 2020.

Study Location: Pediatric hospitalization service at CHU of Libreville, Gabon.

Population Studied: All children hospitalized in this service since the establishment of the archives unit.

Inclusion Criteria: Children aged 1 month to 16 years hospitalized for pleurisy.

Exclusion Criteria: Incomplete records and children hospitalized for conditions other than pleurisy.

Statistical Analysis: Data were entered and analyzed using Epi-info 7. Percentages were used for qualitative data, and means for quantitative data. Pearson's Chi-square correlation test was used to compare proportions.

Ethical and Regulatory Aspects: This study was conducted following the recommendations of the Declaration of Helsinki on medical research involving human subjects.

3. RESULTS AND DISCUSSION

1.1 Results

During the study period, 12,520 patients were hospitalized, including 59 cases of pleurisy, representing a prevalence of 0.47%. The male-to-female ratio was 1.2, with 54.2% of the cases being male. The mean age of the patients was 56.4 months (\pm 56.9 months), with the age group 1 to 5 years representing 50.8% of the cases. In 42.9% of the cases, the parents were unemployed.

Table 1: Patient Distribution by Age and Gender

| Age Group (Years) | Male (%) | Female (%) | Total (%) |
|-------------------|-----------|------------|-----------|
| 1-5 | 30 (50,8) | 20 (33,9) | 50 (84,7) |
| 6-10 | 5 (8,5) | 2 (3,4) | 7(11,9) |
| 11-16 | 1 (1,7) | 1 (1,7) | 2 (3,4) |

The main presenting symptoms were fever (93.2%), cough (66.1%), and respiratory distress (33.9%). There was an association between pleural effusion syndrome and respiratory distress in 44.1% of the cases. Chest radiographs were performed in 98.3% of the cases, revealing unilateral pleural effusion in 89.7%. Most effusions were of moderate volume (51.7%). Pleural ultrasound was performed in 37 patients (62.7%), revealing pleurisy in 60.5% of the cases, with unilateral effusion in 52.6%.

Thoracentesis was performed in 40.7% of the cases, revealing purulent fluid in 62.5% of the cases. Cytological analysis of the pleural fluid showed lymphocyte predominance (53.3%), followed by neutrophils (33.3%).

The identified etiologies accounted for 69% of the cases, including *Staphylococcus aureus* (26%), pleuropulmonary tuberculosis (13.6%), and bacteremia (6.8%) with pathogens such as *Burkholderia cepacia*, *Pantoea spp. 1*, *Serratia odorifera*, *Serratia ficaria*, and *Haemophilus influenzae* associated with *Escherichia coli* (1.7%). The etiology remained unknown in 31% of the cases.

Table 2: Main Identified Etiologies

| Etiology | Number of Cases (%) |
|-------------------------------|---------------------|
| Staphylococcus aureus | 15 (26%) |
| Pleuro-pulmonary tuberculosis | 8 (13.6%) |
| Bacteremia | 4 (6.8%) |
| Unknown etiology | 18 (31%) |

All patients received medical treatment. The initial antibiotic therapy was adjusted based on antibiograms. The first-line antibiotics included amoxicillin-clavulanate, ceftriaxone, and gentamicin. Second-line treatment included ciprofloxacin, lincomycin, levofloxacin, ceftazidime, amikacin, and flucloxacillin.

Antitubercular therapy was initiated for 8 patients with pleuropulmonary tuberculosis, including a four-drug regimen of rifampin, isoniazid, pyrazinamide, and ethambutol for 2 months, followed by a two-drug regimen for an additional 4 months. One patient received corticosteroid treatment.

Thoracic drainage was performed in 22.4% of patients, with the duration of drainage ranging from 3 to 13 days. One child underwent evacuative thoracocentesis, and two others required surgical intervention for encapsulated pleurisy.

Oxygen therapy was prescribed for 45.76% of the patients, and respiratory physiotherapy was used in 1.69%. Antipyretics, bronchial mucolytics, and nasal decongestants were primarily used to treat cough and fever in infants. Three patients (5.08%) required admission to the intensive care unit for an average of 6 days.

Table 3: Main Administered Treatments

| Treatment | Number of Cases (%) |
|-----------------------------|---------------------|
| First-line antibiotics | 59 (100%) |
| Thoracic drainage | 13 (22.4%) |
| Anti-tuberculosis treatment | 8 (13.6%) |

The clinical outcome was favorable for all patients. The hospitalization duration ranged from 2 to 120 days, with an average of 21.6 days. Regular monitoring of complete blood count (CBC) and C-reactive protein (CRP) showed improvement between the 6th and 31st day, with an average of 11.3 days. Radiological improvement was observed between the 11th and 34th day, with an average of 14.7 days. The 8 patients with pleuropulmonary tuberculosis were declared cured after 9 months.

A statistically significant correlation was observed between age and medical history ($p = 0.001$), as well as between age and chest pain ($p = 0.012$). However, no other variable showed a significant relationship with age.

2.2 Discussion

The findings of this study provide important insights into the epidemiology, clinical presentation, and management of pediatric pleural effusion in a resource-limited setting.

The prevalence of pleural effusion (0.47%) observed in this study is consistent with findings from other sub-Saharan studies, although regional variations exist. For example, Mali reports a higher prevalence of 2.5%, likely due to different healthcare-seeking behaviors and diagnostic capabilities [5, 6]. The male predominance is similar to findings in Burkina Faso and other African countries [7].

Fever and respiratory symptoms, particularly cough and distress, were the most frequent clinical presentations, consistent with previous studies highlighting these as characteristic of pediatric pleural effusion [8, 9]. Radiological confirmation remains essential, with chest X-rays providing critical initial diagnostics and ultrasound enhancing effusion characterization, especially in distinguishing exudative from transudative effusions [10].

Bacterial infections, particularly from *Staphylococcus aureus*, emerged as the leading etiology. This underscores the need for vigilance against resistant strains in areas with high antibiotic misuse [11]. The identification of tuberculosis in 13.6% of cases emphasizes its burden in sub-Saharan Africa and the importance of rapid diagnostic tools like GeneXpert in improving detection rates [12, 13].

Therapeutic strategies showed positive outcomes, emphasizing the importance of tailored antibiotic regimens guided by antibiograms. However, reliance on empirical therapy reflects the diagnostic limitations in low-resource settings [14]. Standardized antitubercular therapy yielded satisfactory results in tuberculosis management, in line with global guidelines [15].

Despite these successes, challenges persist. Delayed presentation due to limited access to healthcare often exacerbates disease severity, prolonging hospital stays. Moreover, the absence of advanced diagnostic tools in many settings necessitates reliance on clinical judgment, which may not always suffice.

To address these gaps, the integration of point-of-care diagnostics and strengthening referral systems are recommended. Enhanced training for healthcare providers in recognizing and managing pleural effusion is also critical. Collaboration with international health organizations could help facilitate resource allocation, ensuring timely and accurate diagnostics.

Conclusion

This study highlights the importance of early diagnosis and tailored management in pediatric pleural effusion cases. While *Staphylococcus aureus* and tuberculosis are the predominant etiologies, resource-limited settings require strategic improvements in diagnostic and therapeutic approaches.

Further research and the development of nationwide databases are essential for refining management protocols and reducing morbidity associated with pleural effusion in children.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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