[P25]

Prise en charge des pleurésies infectieuses de l'enfant dans trois hôpitaux du sud du Bénin

Gilles Bognon, Caroline padonou, Lutécia Zohoun, Nicole Tchiakpe, Roméo Dah-Bolinon, Gratien Sagbo

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Prise en Charge des Pleuresies Infectieuses de L'Enfant Dans Trois Hopitaux du Sud du Benin Management of Infectious Pleurisies in Three Hospitals in the South of Benin

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Abstract

Objective: Infectious pleurisy is a frequent hospitalization indication in pediatrics in developing countries. This study aims to describe infectious pleurisies' features and to identify its death factors in three teaching hospitals in Benin. **Design:** This was a prospective, descriptive and analytical study including children aged 01 months to 17 years who were hospitalized in pediatrics in the three hospitals for pleurisy from September to December 2019. **Results:** Among the 3379 children admitted, 25 presented with an infectious pleurisy, making a hospital frequency of 0.74%. The sex ratio was 0.8. The majority (19/25) of the children were less than 5 years old. The mean age was 38 ± 5.88 months. Most of the parents had a low education (42/50) and socio-economic status (18/25). The main symptoms were fever (25 cases), dyspnea (23 cases) and cough (22 cases). The majority of the children (21/25) were up-to-date in regards with the Expanded Immunization Program (EIP) vaccines and none had received non-EIP vaccines. Almost all children (24 cases) had a respiratory distress (24/25). On chest X-ray, there were abundant pleural extravasations in 12 cases. The main pathogens found were *Staphylococcus aureus* (16 cases), *Streptococcus pneumoniae* (3 cases) and *Streptococcus A* (1 case). All children received oxygen and antibiotic therapy; pleural drainage was performed in 22 children. The average length of stay was 14 days ± 6.4. Twenty-one children were healed without sequelae, one child had a post-drainage keloid scar, and two children died. Factors associated with the death of these children were admission delay for more than 7 days (p = 0.035) and presence of respiratory distress (p = 0.049). **Conclusion:** Pleurisy

remains a concern for children admitted in our hospitals and early management is imperative.

Keywords

Infectious Pleurisy, Respiratory Distress, Pleural Drainage

1. Introduction

Infectious pleurisy is a fluid effusion in the pleural cavity caused by a germ. It is a relatively frequent hospitalization reason in pediatric departments, both in developed and developing countries [1] [2]. Its clinical diagnosis is easy, but the identification of the germ is sometimes difficult in our countries due to the technical facilities limitations [3]. However, the identification of the germ not only makes it possible to orientate antibiotic therapy, but also to ensure epidemiological surveillance. The morbidity related to infectious pleurisy is significant and characterized by a delay in diagnosis and management, prolonged hospitalization, frequent invasive procedures and the occurrence of certain complications [4]. In developed countries, the outcome of infectious pleurisy is generally good [5]. On the other hand, WHO estimates that 19% of under-five children's deaths (particularly in developing countries) are secondary to pneumopathies' complications, pleurisy especially [6]. A study carried out in Benin among children with pleurisy at the National Teaching Hospital of Cotonou from 2004 to 2008 found a hospital frequency varying from 12.7% to 26.8%; the majority (84.5%) of the children were under 5 years of age; the main germs isolated were *Staphylococcus aureus* in 4 cases, *Klebsiella pneumoniae* in 2 cases; and once, *Streptococcus pneumoniae*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Haemophilus influenzae b*; the lethality was 5.6% [2]. Ten years after this study, the technical facilities had been improved in three teaching hospitals in the south of Benin (the Departmental Teaching Hospital of Oueme and Plateau in Porto-Novo, the Lagoon Mother-Child Teaching Hospital in Cotonou and the National Teaching Hospital Hubert Koutoucou Maga in Cotonou). The objective of this study is to identify the factors related to the infectious pleurisy occurrence and those associated to death among the children hospitalized in these three hospitals in order to improve their management.

2. Method

This cross-sectional, prospective, descriptive and analytical study took place from September 2019 to December 2019. It included children aged one month to 17 years hospitalized during the study period for pleurisy in the pediatric departments of the Departmental Teaching Hospital of Ouémé and Plateau in Porto-Novo, the Lagoon Mother-Child Teaching Hospital in Cotonou and the National Teaching Hospital Hubert Koutoucou Maga in Cotonou. In the recent

years, the technical facilities of these three hospitals have been improved with the provision of qualified personnel and bacteriology tests accessibility. The recruitment was exhaustive, any child presenting with a pleural liquid effusion confirmed on standard face, and profile chest X-ray with an infectious context was included in this study.

Pleural fluid collection was systematic. The collected fluid was sent to the multipurpose clinical biology laboratory of the Lazaret National Hospital of Pneumo-Phthisiology in Cotonou. A microbiological (aerobic and anaerobic bacteria, Kock's bacillus, others) and cytological (count, cell formula, search for abnormal cells) analysis, as well as the search for proteins in biochemistry were systematically performed. In addition, the children had a complete blood count, a C Reactive Protein dosage and an HIV serology test. Subsequently, pleural drainage was performed when indicated [7]. The same pleurisy management protocol was used in the three hospitals. This protocol included a probabilistic antibiotic treatment started immediately while waiting for the germ identification and the antibiogram. Once the antibiogram was available, the treatment was adjusted according to the result. Hospitalization costs were bore by the parents. Written informed consent was obtained from the parents before the children were included.

The variables studied were sociodemographic characteristics (age, sex, parents' and child's education level, parents' socioeconomic level, promiscuity), treatment before admission, personal and family history (immunization status with regards to the expanded immunization program or not, history of lower respiratory infection, HIV infection, malnutrition, allergy, family smoking, congenital heart disease, etc.), physical examination findings (vitals, anthropometric parameters, skin lesions, respiratory, digestive, hemodynamic and neurological findings, macroscopic aspect of the pleural punctured fluid), paraclinical examination findings (chest X-ray, chest ultrasound, cytobacteriological study of the punctured fluid, biochemistry and hemogram, C Reactive Protein), the treatment instituted (oxygen, antibiotics, drainage, physiotherapy, analgesics, antipyretics) and the evolution data (length of stay, complications, sequelae and death). Severe respiratory distress was defined by a change in respiratory rhythm associated with at least one sign of struggle, the presence or absence of cyanosis and an oxygen saturation below 80% [8].

Data was collected from patients records through a written survey and parent interviews Data were coded, entered and analyzed using Epi data and SPSS 25 software. Quantitative variables were expressed as average with standard deviation while qualitative variables were expressed as frequency. Averages were compared with Student's t test and frequencies with Pearson's chi^2 or Fisher's exact test as appropriate. A multivariate analysis according to the logistic regression model with stepwise iterations was used by introducing in the model all the variables whose p-value in univariate analysis is less than or equal to 20%. For all comparisons, the difference will be considered as significant for a p-value lower than 5%.

3. Results

3.1. Socio-Demographic Characteristics

During the study period, 25 children had presented with infectious pleurisy out of 3379 admitted, with a hospital frequency of 0.74%. The mean age was 38 ± 5.88 months and under 5 years children were more represented (19/25). The sex ratio was 0.8 with 11 boys and 14 girls. The majority of parents had a low education level (42/50) and the socio-economic level was low as well in most families (18/25). Almost half of the children lived in promiscuity (12/25).

3.2. Clinical Features

From the disease onset, the time to hospital admission was at least one week in 16 children. Fever (25/25), dyspnea (23/25) and cough (22/25) were the main onset symptoms. More than two out of three children (17/25) had received an antibiotic before admission. The vaccination was complete (21/25) with respect to the Expanded Immunization Program and no child received non-EPI vaccine. Physical examination revealed a good nutritional status in 22 children, a respiratory distress in 22 cases (including two severe cases), a clinical pleural effusion in all children, and skin lesions such as abscesses or pustules in six cases. The pleuropulmonary system examination also found a pleural fluid effusion syndrome in all the children, consisting of unilateral pulmonary dullness or sub-dullness, and a reduction or abolition of the vesicular murmur. The punctured pleural fluid was purulent in 13 cases and citrine yellow in 11 cases.

3.3. Paraclinical Characteristics

Various radiological images were observed. The pleural fluid effusion was massive in 12 cases, moderate in six cases and minimal in three cases. The chest X-ray showed a pyopneumothorax image in four children. The Cytological investigation of the pleural fluid revealed predominantly neutrophilic hyperleukocytosis in 23 cases. The following germs were found: *Staphylococcus aureus* (16/25), *Streptococcus pneumoniae* (3/25) and *Streptococcus A* (1/25). In four children no germs were isolated. *Mycobacterium tuberculosis was* not isolated from any child. Blood cultures were performed in seven children and isolated *Staphylococcus aureus* in six cases and *Streptococcus pneumoniae* in one case. In these cases, the same germ was found in the pleural puncture fluid. A predominantly neutrophilic hyperleukocytosis was noted in the blood count and the C Reactive Protein was above 86 mg/l in all children. In 12 children there was anemia with hemoglobin level below 7 g/dl. Table 1 shows the antibiogram results in relation to the sensitivity of the isolated germs.

None of the children was HIV infected.

3.4. Therapeutic and Evolution Characteristics

All the children had been given oxygen for 7 ± 3 days in average. A pleural drainage was performed in most of the children (22/25) and a blood transfusion in

Table 1. Results of the sensitivity of the different germs.

	Sensitive antibiotics	Resistant antibiotics
Staphylococcus aureus	Fusidic acid, Amoxicillin/clavulanic acid, Cotrimoxazole, Ciprofloxacin, Gentamicin	Ampicillin, Amoxicillin, Nalidixic acid, Penicillin G, Doxycycline
Streptococcus pneumoniae	Erythromycin, Cefoxitin, Cefuroxime, Lincomycin, Ofloxacin, Norfloxacin	Tetracycline, Aztreonam, Ticarcillin
Streptococcus A	Ampicillin, Amoxicillin, Nalidixic acid, Penicillin G, Amoxicillin/clavulanic acid Cotrimoxazole, Ciprofloxacin, Gentamicin, Erythromycin, Cefoxitin, Cefuroxime,	Fusidic acid, Lincomycin, Ofloxacin, Norfloxacin

four children. Gentamycin was used in all children, cefotaxime in 14 and lincomycin in 10. The average length of stay was 14 days ± 6.4 days. At the end of the treatment, 21 children had a favorable outcome with complete healing without sequelae, one child had an unaesthetic keloid scar after drainage and two children died in a context of severe multivisceral distress.

The factors identified as associated with death in these children were a time to hospital admission of more than seven days from disease onset ($p = 0.035$) and a severe respiratory distress ($p = 0.049$). The socio-demographic factors, the treatment before admission, the responsible germ, the chest X-ray and the treatment instituted were not statistically linked to the unfavorable evolution of pleurisy.

4. Discussion

The small size of the sample, the anarchic use of antibiotics before admission were limits to this study. In this study, the hospital frequency of infectious pleurisy in children was 0.74% in the three teaching hospitals. Various studies carried out in southern Sahara found variable hospital frequencies. They were 0.6% and 2.8% in two studies that globally dealt with pleurisy and 1.04% in another which focused on purulent pleurisy [1] [3] [9]. This variability in hospital frequencies in an almost identical environment in sub-Saharan Africa would probably be due to the samples' size, the average children's age in each study, the duration and period of the study, and the immunization and nutritional status of these children. The sex ratio was 0.8 and the majority of children were under 5 years of age. Other studies conducted in Africa had noted a predominance of male and under 5 years children [1] [2] [4]. This could be explained by the high susceptibility of young infants to infections due to their immature immune system. The majority of the parents had a low level of education (42/50) and the socio-economic level was low in most families (18/25). This observation was made by another Senegalese author [10]. Indeed, poverty favors respiratory infections occurrence because it would be responsible for malnutrition by lack of intake. Most of the children in the present study (21/25) were up to date with the vac-

cines recommended by the Expanded Immunization Program in Benin. This immunization probably conferred them a protective effect against certain pathogens with a respiratory tropism such as Koch's bacillus, *Morbillivirus*, *Hemophilus influenzae b* and *Bordetella pertussis* which are currently covered by this program in our country. This explanation had been given by two other authors [2] [11]. The time to admission was more than 7 days in 16 children and the main symptoms were fever, dyspnea and cough. Two African authors obtained the same delay [10] [12]. The delay in admission could be explained by the therapeutic itinerary of patients often passing through the traditional practitioner and then peripheral health structures before reaching the last level of recourse which is the Teaching Hospital. The symptoms of pleurisy (fever, cough and dyspnea) were reported with varying frequency by different authors and constitute the frequent triad of pleuropulmonary staphylococcal disease in infants [10] [13]. Almost all the children presented with respiratory distress (24/25) as in other studies [12] [14]. They had a liquid pleural effusion syndrome as described by some authors [11] [15] [16]. The pleural effusion was large on chest X-ray in 12 cases as found in another study [9]. This would probably be due to the long delay between the onset of the disease and the time of admission to the Teaching Hospitals. The noisy clinical signs presented by these children are related to respiratory intolerance due to the abundance of effusions. The main germs found were *Staphylococcus aureus* (16/25), *Streptococcus pneumoniae* (3/25) and *Streptococcus A* (1/25). These germs had been isolated in two other studies, one of which is African and the other Indian [17] [18]. In two other studies, *Streptococcus pneumoniae was* the most common germ with proportions of 75% and 82% [19] [20]. *Haemophilus influenzae b* was isolated in two Malian studies in 2005 and 2009 [11] [16]. This germ had not been isolated in the present study probably because of the introduction of its vaccine in the infant immunization program since 2002. The sterile culture of pleural fluid in 5 cases is probably due to the self-medication practiced by many parents and the sometimes-abusive antibiotics prescription in peripheral health centers before admission to hospital. A Malian study also revealed self-medication in more than half of its study population [3]. All the children had received oxygen and double antibiotic therapy, initially probabilistic and then adapted to the antibiogram as indicated in any infection. The pleural effusion was drained in 22 children. In a study where healing was obtained in all cases, drainage was systematic and early [21]. For another author, the only formal indication for pleural drainage is poor clinical tolerance due to pleural effusion [7]. The average length of stay (14 days ± 6.4) was close to that found by Camara T [16]. At the end of the treatment, 21 children were healed without sequelae and two died. In several studies, cases of death had been reported [3] [14] [17]. The factors associated with the death of these children were the long delay before admission ($p = 0.035$) and respiratory distress ($p = 0.049$), reflecting a delay in management. It is therefore important to review the care organization to reduce this delay of pa-

tients admission in order to limit complications and reduce mortality.

5. Conclusion

This study allowed us to describe the characteristics of children hospitalized for pleurisy and the factors associated with death in those children. The biological investigation systematically carried out contributes to the epidemiological surveillance of the germs responsible for invasive infection. It is therefore important to overcome the delay in patients' admission by reorganizing the care in order to limit complications and mortality.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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