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Bacteriological Profile of Effusion Fluids Infections at Charles De Gaulle University Pediatric Hospital from 2017 to 2020

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Abstract

Introduction: Microbiology of effusion fluids in children in Burkina Faso is characterized by the scarcity of data. This work aimed to study the bacteriological and antibiotics susceptibility profile of bacteria involved in effusion fluid infections in paediatrics in order to improve the choice of probabilistic antibiotics therapy. **Methods:** A cross-sectional, descriptive study was used in children aged 0 to 15 years from 2017 to 2020 at the Charles De Gaulle Pediatric University Hospital Center (CHUP-CDG) in Ouagadougou. Classical bacteriology methods such as macroscopy, Gram staining, identification galleries and antibiotics susceptibility testing were used. **Results:** Of 231 samples, 64 bacteria were isolated. The most common bacterial strains of pleural fluid were *Staphylococcus aureus* (25%) and 40% for *Enterobacteriaceae*. Of the peritoneal fluid, 77% were *Enterobacteriaceae* with 57% *Escherichia coli*; and from joint fluid, 33% were *S. aureus* and 22% for *P. aeruginosa*. The overall susceptibility profile showed 29% extended-spectrum beta-lactamase-producing *Enterobacteriaceae* (ESBL), 10% methicillin-resistant *S. aureus* (MRSA), and 8% carbapenemases. **Conclusion:** Bacteriological profile is characterized by ESBL-producing *Enterobacteriaceae* and MRSA. The most active antibiotics were macrolides, aminoglycosides, and cefoxitin (methicillin) for Gram-positive cocci, carbapenems, and aminoglycosides for Gram-negative bacilli. Then,

the monitoring of antibiotics resistance must be permanent.

Keywords

Bacteriological Profile, Effusion Fluid, Infections

1. Introduction

Effusion fluids (pleural, pericardial, peritoneal, and articular) result from the presence of an abnormal amount of fluid in the serous fluids. There are two types of effusion: non-inflammatory (paucicellular transudate) and inflammatory (neutrophil-rich exudate). They are normally closed and sterile, with no relation to the outside. In developed countries, the bacteriological and epidemiological characteristics of effusion fluid infections in paediatric settings are well studied. In pleural fluid, *Streptococcus pneumoniae*, *Streptococcus spp*, and *Staphylococcus aureus* are the most isolated pathogens [1] [2]. After the introduction of the thirteen pneumococcal conjugate vaccine (PCV-13), the microbiology of pleurisy has changed with an increasing number of *S. aureus* methicillin-resistant [3]. The bacteriological profile of paediatric pericarditis is characterized by *S. aureus*, *S. pneumoniae*, *Streptococcus spp*, *Haemophilus influenzae* and *Neisseria meningitidis* [4] [5] [6]. In Asia, Europe and America, some studies mainly presented *Enterobacteriaceae* such as *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* as bacteria responsible for pediatric peritonitis [7] [8]. Several bacteria are implicated in joint fluid infections. Thus, *S. aureus* on behalf of its bone tropism remains the most common pathogen found in Australia and France [9] [10], especially with the scarcity of *S. pneumoniae* and *H. influenzae* through vaccination. However, *Kingella kingae* is an emerging pathogen in joint infections [9].

In sub-Saharan Africa, the most common micro-organisms in paediatric pleurisy are *S. aureus*, *Mycobacterium tuberculosis*, *S. pneumoniae*, *P. aeruginosa*, and *Enterobacteriaceae* [11] [12] [13]. With regard to pericardial infections, Weli et *al* had described culture-negative bacterial pericarditis in Tunisia. Otherwise, some previous data had isolated *Staphylococcus spp*, *S. pneumoniae* and *H. influenzae* [14]. Most pathogens isolated from the peritoneal fluid are part of the normal flora of the skin, nasopharynx or intestine (Ferroni, 2007). The most common pathogens in Africa are *Enterobacteriaceae*, *Staphylococcus spp* and *Streptococcus spp* [15] [16]. The microbiology of joint infections in this area is not much different from that in other parts of the world. The most isolated pathogens are *S. aureus*, *K. kingae*, *Streptococcus spp* and Gram-negative bacilli [17] [18].

In Burkina Faso, the bacteriological and epidemiological characteristics of effusion fluids in paediatric settings have been poorly studied. Indeed, data on the bacteriological profile in children are scarce. Nevertheless, some practition-

ers at the CHUP-CDG had isolated *S. aureus*, *S. pneumoniae*, *P. aeruginosa* and *Enterobacteriaceae* in pleural fluid [19]. In addition, work on joint fluid in a pediatric environment at the CHU-YO had revealed the presence of bacteria such as *Staphylococcus spp Pseudomonas spp*, *Streptocoque spp*, and *Enterobacteriaceae* [20]. Indeed, infections of effusion fluids sometimes lead to serious, disabling infectious pathologies, difficult to treat, which can lead to high morbidities and mortality. The cytobacteriological examination of these puncture fluids is therefore essential in the early treatment of the patient [21]. However, the urgency of the situation and the wasting time force clinicians to start a presumptive treatment. Antibiotic therapy is therefore probabilistic and is based on the nature and susceptibility to antibiotics of the reported pathogens from previous data [22]. Similarly, antimicrobial resistance (AMR) has become a major public health problem around the world. This led WHO to advice its States Members to adopt the Global Action Plan on Antimicrobial Resistance in 2015. Therefore, this AMR context requires more caution in the choice of probabilistic treatments, which must be based on evidence data. Hence, the absolute necessity to know the mapping of pathogens according to pathological products and their susceptibilities to antimicrobials in order to make a better choice of antibiotics for presumptive treatment is expected. In addition, as far as we know, there is very little discussion of the subject in our context. From this point of view, the determination of bacteriological profile with their antibiotics susceptibility in effusion fluids infection in a paediatric hospital can contribute to suggesting some treatment regimens adapted to the isolated bacterial ecology. Thus, the objective of this work is to study the bacteriological profile of effusion fluids received and analyzed at the bacteriology-virology department of the CHUP-CDG.

2. Materials and Methods

This is a cross-sectional, descriptive study from August 1, 2017 to July 31, 2020. The biomedical analysis laboratory of CHUP-CDG had housed the bacteriology-virology department where this work took place, which concerned puncture fluids, specifically effusion fluids.

in-patients or on out-patients basis in whom a puncture of the effusion fluid had been performed with a prescription for cytobacteriological examination. Had been included in this work, all patients whose effusion fluids were received at the Medical Biology Analysis Laboratory with sociodemographic and biological data completed. The sampling was a census of cases of effusion fluids transcribed in the record books. The variables selected were age, sex, service, bacterial species identified and antibiotics susceptibility testing results. Data entry and processing were done using Excel. Quantitative and qualitative cytology had been done. Culture was done using Purple Bromo-Cresol (BCP), Cystine-Lactose-Deficient Electrolyte (CLED); chocolate agar with Polyvitex® (GC + PVX). Heart-brain broth (CCB) was used to enrich microorganisms. The mini-

mal Leminor or API 20E galleries (Bio Mérieux) were used for the identification of Gram-negative bacilli while Dnase, Bile Esculin Azide (BEA) media and NaCl-added base agar were used for the identification of Gram-positive cocci. Antibiotics susceptibility testing was performed according the latest recommendations of the Antibiogram Committee of the French Society of Microbiology (CA-SFM 2017). All patient informations were collected in accordance with the rules of professional conduct and ethics. Confidentiality and anonymity of patients included in this study have been respected in accordance with the rules of medical ethics and the legislation on biomedical and scientific research. Authorization from the General Management of the CHUP-CDG covering the study period has been obtained for the collection and use of laboratory data according to annex.

3. Results

Of 231 samples received, effusion fluids included pleural fluids represented 46% (106/231) and peritoneal fluids at 39% (91/231). Joint and pericardial fluids were accounted respectively for 13% (30/231) and 2% (4/231).

3.1. Socio-Demographic Characteristics of Patients

Of 231 patients included, the age ranged from 31 - 59 months is more representative with 54.7% for men and 50.7% for women; in each of these genders as showed in Table 1. There is no significant difference among the age groups (P = 0.777).

Table 1. Distribution of effusion fluids by age and sex.

Age Groups (Months)	Sex			
	F	M	Total	*P-value*
[1 - 5]	4 (5.3)	13 (8.3)	17 (7.4)	0.777
[6 - 30]	30 (40.0)	64 (41.0)	94 (40.7)	
[31 - 59]	41 (54.7)	79 (50.7)	120 (51.9)	
Total	75 (100.0)	156 (100.0)	231 (100)	

The [31 - 59 years] age group had more cases in both sexes with 51.9%. However, the difference is not statistically significant at the 5% level.

3.2. Distribution of Patients According to Age and Body Fluid

Table 2 below shows the distribution of patients by age groups and types of effusion fuids. There is any statistically significant difference at the 5% level among the age groups (P = 0.090).

Although the 31 to 59 age group appears to be the most affected, the difference is not statistically significant at the α = 5% (P = 0.090) level.

Table 2. Distribution of patients by age and body fluid.

Age Groups	Biologics (%)					Total	*P-value*
	Articular	Ascites	Pericardial	Peritoneal	Pleural		
[1 - 5]	6 (20)	4 (6.7)	1 (25.5)	2 (6.3)	4 (3.8)	17 (7.3)	
[6 - 30]	12 (40)	22 (37.3)	0 (0.0)	13 (40.6)	47 (44.3)	94 (40.7)	0.090
[31 - 59]	12 (40)	33 (56.0)	3 (75.5)	17 (53.1)	55 (51.9)	120 (52.0)	
Total	30 (100)	59 (100)	4 (100)	32 (100)	106 (100)	231 (100)	

3.3. Distribution of Patients According to Clinical Services

Considering the distribution of patients according to clinical services, surgical emergencies recorded the most important cases with 25.1% [95% CI: 19.6% - 33.7%] (**Table 3**).

Table 3. Distribution of patients by clinical services.

Service	Frequency	Proportion	95% IC
Surgery	42	18.2	12.3 - 26.9
Grandchild	18	7.8	4.9 - 12.1
Infectious Diseases	14	6.1	3.6 - 10.0
Infant	6	2.6	0.9 - 8.1
Oncology	2	1.6	0.2 - 3.4
Resuscitation	8	3.5	1.7 - 6.8
Surgical Emergencies	58	25.1	19.6 - 33.7
Medical Emergencies	51	22.1	17.2 - 27.9
External	32	13.0	9.0 - 26.6
Total	231	100	-

Following the distribution of patients by department, we have the distribution of samples according to clinical services.

3.4. Distribution of Biologics by Clinical Services

Table 4 below gives the distribution of fluids effusion according the clinical services.

Table 4. Distribution of samples by clinical service.

Service	Pathological product				Total
	Pleural	Pericardial	Peritoneal	Articular	
Surgery	14	2	19	7	42
Grandchild	7	0	11	0	18
Infectious Diseases	6	0	7	1	14
Infant	1	0	5	0	6

Continued

Oncology	2	0	0	0	2
Resuscitation	4	1	4	0	9
Surgical Emergencies	30	1	15	12	58
Medical Emergencies	34	0	15	3	52
External	8	0	15	7	30
Total	106	04	91	30	231

Surgical emergencies, medical emergencies and surgery had 58, 52 and 42 biologics, respectively.

3.5. Distribution of Bacterial Strains According to Services

Of 231 samples, 62 cultures were positive and 64 bacterial strains were identified. *E. coli* was most representative with 25 strains followed by *S. aureus* with 10 strains and *K. pneumoniae* with 9 strains. *Streptococcus spp* was less found with only 2 cases (Table 5).

Table 5. Distribution of bacterial strains by services.

	E. coli	*K. pneumoniae*	*Pseudomonas spp*	*S. aureus*	*S. saprophyticus*	*Streptococcus spp*	Other	Total
UC	5	2	1	1	2	0	1	12
ONE	3	1	1	3	3	1	1	13
Surgery	13	2	2	3	0	0	1	21
External	3	0	1	0	0	1	0	5
GE	0	1	0	0	1	0	0	2
MI	0	2	0	0	0	0	0	2
Réa	1	1	3	1	0	0	0	6
Other	0	0	0	2	1	0	0	3
Total	25	9	8	10	7	2	3	64

Legend: UC (Surgical Emergencies); UM (Medical Emergencies); GE (Big Kids); MI (Infectious Diseases); Sheave (Resuscitation).

3.6. Frequency of Bacterial Strains According to Effusion Fluid

Out of 231 samples, 62 cultures were positive and 64 bacterial strains were identified (27%). The most common bacteria were *E. coli* (39.7%) and *S. aureus* (15.9%).

3.6.1. Bacterial Strains Isolated from Pleural Fluid

Of the 106 pleural punctures collected, 20 bacterial strains were isolated by culture. Among the bacterial strains isolated, *Staphylococcus aureus* was the most represented (25%), followed by *E. coli* and *Pseudomonas spp* (20% for each bacterium). Table 6 shows the distribution of strains isolated from pleural fluid.

Table 6. Bacterial strains isolated from pleural fluid.

Pathogens	Frequency	%
S. aureus	5	25
E. coli	4	20
Pseudomonas spp.	4	20
K. pneumoniae	3	15
S. saprophyticus	2	10
Streptococcus sp	1	5
Citrobacter sp	1	5
Total	20	100

3.6.2. Bacterial Strains Isolated from Peritoneal Fluid

There were 35 bacteria isolated from 91 peritoneal fluids. Thus, there was a polymicrobial culture with two bacteria. The most common bacterial strains were *E. coli* (57%) and *K. pneumoniae* (17%). **Table 7** below shows the bacterial strains found in the peritoneal fluid.

Table 7. Bacterial strains isolated from peritoneal fluid.

	Frequency	%
E. coli	**20**	57
K. pneumoniae	**6**	17
S. saprophyticus	4	11
S. aureus	2	6
P. aeruginosa	2	6
E. agglomerans	1	3
Total	35	100

3.6.3. Bacterial Strains Isolated from Joint Fluid

Of these samples, 8 were culture-positive, including a two-germ polymicrobial. The most involved bacteria were *S. aureus* at 33% of the germs and *P. aeruginosa* at 22%. **Table 8** below shows the distribution of the identified bacterial strains in joint fluid.

Table 8. Bacterial strains isolated from joint fluid.

	Frequency	%
S. aureus	3	33
P. aeruginosa	2	22
S. saprophyticus	1	11
Streptococcus sp	1	11
Enterococcus sp	1	11
E. coli	1	11
Total	9	100

3.6.4. Bacterial Strains Isolated from Pericardial Fluid

For the 4 pericardial fluids, no germs were isolated.

For the sample which was positive on culture, bacterial strains underwent antibiotics susceptibility testing.

3.7. Antibiotics Susceptibility Profile of Isolated Bacterial Strains

In the following lines, we described the antibiotics susceptibility profile of bacterial profiles according to the type of effusion fluid.

3.7.1. Antibiotics Susceptibility Profile of Bacteria Isolated from Pleural Fluid

Out of 20 bacterial strains isolated from pleural fluids, 07 resistance phenotypes were identified, including 03 Gram-negative bacilli (GNB) that were ESBL-producing and 04 Gram-positive cocci (CGP) resistant to penicillin G. All strains of staphylococci were susceptible to cefoxitin. Table 9 shows the antibiotics susceptibility of these strains.

Table 9. Antibiotics susceptibility of bacteria isolated from pleural fluid.

Antibiotics	Bacteria			
	Staphylococci (n = 7)	Streptocoques (n = 1)	*Enterobacteriaceae* (n = 8)	Pseudomonas (n = 4)
Penicillin G	3/6	0/1	-	-
Cefoxitin	7/7	-	-	-
Erythromycine	6/7	1/1	-	-
Clindamycine	6/7	1/1	-	-
Gentamicine	3/3	0/1	3/6	2/2
Ciprofloxacine	4/4	-	4/6	4/4
Cotrimoxazole	4/5	0/1	1/8	-
AmoxiClav	-	-	1/7	1/2
C3G	-	-	1/8	2/3
Imipenem	-	-	4/4	1/1

Legend: AmoxiClav: Amoxicillin + Clavulanic Acid; C3G: Third-generation cephalosporins (Ceftriaxone/ceftazidime).

3.7.2. Antibiotics Susceptibility Profile of Bacteria Isolated from Peritoneal Fluid

In this work, 35 bacterial strains were isolated from peritoneal puncture fluids. Of these, 09 (33%) strains of Enterobacteriaceae were ESBL-producing, 04 (17%) NGBs were resistant to imipenem, and 20% were MRSA-resistant. Resistance to penicillin G from *Staphylococcus spp* was 83%. Table 10 below highlights antibiotics susceptibility of strains isolated from peritoneal fluid.

Table 10. Antibiotics susceptibility of bacteria isolated from peritoneal fluid.

Antibiotics	Bacteria		
	Enterobacteriaceae (n = 27)	*Pseudomonas spp* (n = 2)	*Staphylococcus spp* (n = 6)
Ampicillins	0/13	-	-
AmoxiClav	3/23	0/1	-
Chloramphenicol	20/20	0/1	-
C3G	3/24	1/2	-
Imipenem	18/21	1/2	-
Gentamicine	9/17	1/2	4/5
Ciprofloxacine	4/20	1/2	2/5
Cotrimoxazole	0/21	0/2	4/6
Cefoxitin	-	-	4/5
Penicillin G	-	-	1/6
Erythromycin	-	-	5/6
Clindamycin	-	-	5/6

Legend: AmoxiClav = Amoxicillin + Clavulanic Acid; C3G = Ceftriaxone/ceftazidime.

3.7.3. Antibiotics Susceptibility Profile of Bacteria Isolated from Joint Fluid

In joint fluid, 09 bacterial strains were isolated. Antibiotics susceptibility showed that isolated staphylococci were sensitive to cefoxitin (4/4) and all PGCs resistant to Penicillin G (3/3). Table 11 presents details on antibiotics susceptibility.

Table 11. Antibiotics susceptibility of bacteria isolated from joint fluid.

Antibiotics	Bacteria		
	Staphylococci (n = 4)	Streptocoque (n = 1)	*Pseudomonas spp* (n = 2)
Penicillin G	0/3	0/1	-
Erythromycine	2/4	1/1	-
Clindamycine	4/4	1/1	-
Gentamicine	4/4	1/1	2/2
Ciprofloxacine	3/3	-	2/2
Cotrimoxazole	2/4	1/1	1/2
Cefoxitin	4/4	-	1/1
Ceftazidime	-	-	2/2
Imipenem	-	-	2/2

At the end of the presentation of the results of antibiotic susceptibility according to the bacteria involved in fluid infections, we propose a synthesis of ac-

tive antibiotics by treated biological product.

4. Discussion

Ytobacteriological examination of children's effusion fluids had particular importance because it only allows epidemiological surveillance but above all guides the antibiotics therapy instituted. In this study, we were interested for bacteriological profile of effusion fluids infection. Of all effusion fluids, pleural fluid remains the most frequent, with 106 cases collected in three years in this study. Some authors had received 104 pleural fluids for 3 years also at the same health facility [19]. However, in Lubumbashi, a team had collected 44 cases over two years [12]. In our series, Pericardial fluids were rarer with only 04 cases collected. This can be justified because purulent pericarditis is a relatively rare condition [6]. It had always been so, according to the data already reported. In our context, the scarcity of pericardial fluids could also be explained by the low incidence of this infection on the one hand, but also by the fact that the technical platform remains to be strengthened by the lack of a cardiology specialist on the other hand.

Sociodemographic Characteristics of Patients

❖ **Age distribution**

This distribution is common in paediatrics and has also been used by some authors [12] [19] [23]. The most affected age group is older children and adolescents aged 31 - 59 months, regardless of the effusion fluid involved. This age group accounted for 56.7% of cases and the mean age was 75.8 months. The same trend has been reported by previous studies [15] [24] [25]. For joint and pericardial fluid, no cases were collected in infants.

❖ **Frequency of bacterial strains according to effusion fluid**

The overall bacteriological profile of the effusion fluids showed *Enterobacteriaceae* as *E. coli*, *K. pneumoniae* and Staphylococci. All these microorganisms are commensal to the skin or mucous membranes. This could mean that the infection of the effusion fluids would come from a local commensal flora. According to François Dénis, infections of effusion fluids could be the consequence of the extension of a local infection or bacterial translocation from the digestive flora or bacterial dissemination by the blood-borne route from a primary focus [21].

Pleural fluid: In pleural fluid, we had 35% *Staphylococcus spp* whose *S. aureus* (25%) and 20% strains of *Pseudomonas spp*. Some studies in Burkina Faso had yielded *Pseudomonas spp*. (19.2%) and *S. aureus* (30.8%) [19]. Likewise in Democratic Republic of Congo and Benin, it also meant a predominance of strains of *S. aureus* respectively 30% and 40% [12] [13]. In addition, 40% of *Enterobacteriaceae* were also isolated. In the literature, *Enterobacteriaceae* ranging from 7% to 30% had also been reported in the sub-Saharan zone [12] [13] [19]. However, only 5% of *Streptococcus spp* have been isolated in our work, while

strains of *S. pneumoniae* are described. A prevalence of *S. pneumoniae* who goes 10% in Lubumbashi at 39.8% in Dakar [11] [12] [13]. The absence of *S. pneumoniae* in this study could be explained by the introduction of PCV13 in the Expanded Programme on Immunization on the one hand and sampling fluctuations on the other hand. In addition, there is evidence that *S. aureus* would be predominant in developing countries, while the *S. pneumoniae* predominates in developed countries [13].

Peritoneal fluid: The bacteria responsible for community peritonitis is mainly from the intestinal flora with a predominance of *E. coli* [23] [26]. The bacteriological profile of bacterial strains isolated from peritoneal fluids showed: *E. coli* 57%, *K. pneumoniae* 17%, *P. aeruginosa* 6%. Bhat's and Dumont's teams have reported similar cases in India and France [24]. However, in Bamako, one team reported 29% of *E. coli* and 36% other *Enterobacteriaceae* [16]. Some teams had drawn up the bacterial profile of European paediatric peritonitis by showing a similar profile to ours with 65.1% *E. coli*, 10% *Klebsiella spp* and *P. aeruginosa* respectively [7]. Indeed, the difference in proportion with this study could be explained either in the size of the sample since this study concerned more than 1259 germs isolated from 16 countries, or by the fact that Gram positive cocci were not taken into account in their study. In addition, 17% of Staphylococci were isolated. Dumont and Castagnola teams had reported 11% and 5% of CGP successively in their series [24] [27].

Strains isolated from Joint fluid: In joint infections, *S. aureus et K. kingae* are the most common bacteria; better, *K. kingae* had even become the first pathogen responsible for septic arthritis in infants. Our data showed a bacteriological profile dominated by CGP (66%). Indeed, *S. aureus* accounted for one-third of the strains. In Tunis, some studies found a similar profile with 31.8% of *S. aureus* and Gram-negative bacilli in 45% of cases [17]. In Morocco, according to research conducted in 2012, the authors reported a clear predominance of *S. aureus* 73% [15]. In 2005, in Australia, it was concluded that *S. aureus* was the most isolated strain in 76% of cases of hematogenous osteomyelitis and 39% of septic arthritis [25]. In addition, according to the results of work using classical culture, the etiological diagnosis is missing in 50% to 80% of cases [10]. Likewise, *K. kingae* is a pathogen emerging from very difficult crops. This could justify its absence among the isolated pathogens.

Pericardial fluid: Although, any pathogens were isolated from the pericardial fluid. Cytology revealed that half of the samples had a lymphocytic cytological profile. This could refer to a viral, tuberculous or idiopathic etiology. The macroscopic and microscopic appearance reveals that the other half of the effusions were haemorrhagic. Earlier studies had already made similar observations [28]. This most often refers to a tuberculous etiology. In some underdeveloped geographic areas, massive pericardial effusion and cardiac tamponade are frequently secondary to tuberculosis. At the end of this presentation of bacteria by type of effusion fluid, it's important to look about their antibiotics susceptibility profile.

Antibiotic susceptibility profile: The antibiotic susceptibility profile of the 64 isolated bacterial strains showed 30 resistance phenotypes. Of these, 33% of *Enterobacteriaceae* strains are ESBL producing. According to the results of a study carried out, the lack of routine surveillance in most countries and in the West African region does not allow for an accurate estimation of the proportions of ESBL among strains isolated during infectious processes [22]. Nevertheless, in Guinea-Bissau, 32.6% ESBL carriage in children under 5 years of age has been described [29]. Similarly, among the hospital population, a prevalence of ESBL carriage of 31% among children hospitalized for malnutrition in Niger was reported [30]. In Ghana, authors reported that 49.4% of *Enterobacteriaceae* isolated at Korle-Bu Hospital were ESBL-producing [31]. Then, the prevalence of ESBLs in our work is consistent with that previously described in West African Region. In addition, we also had 13% carbapenem-resistant strains. Carbapenemase-producing strains have also been described in Sierra Leone and Senegal [32] [33]. In Nigeria, varying prevalences have been reported depending on the level of care: for example, in regional hospitals, the prevalence is about 10% compared to 36% in reference [34] [35] [36]. All these different studies show that we are facing an emergence of resistance to carbapenems.

We report 10% resistance to methicillin. Some authors had isolated 37% of MRSA from pleural fluid [19]. This finding is consistent with the prevalences of MRSA in the sub-Saharan African region with 10% in Yaoundé, 13% in Niamey, 34% in Dakar and 36% in Benin [37] [38].

We note that strains isolated from peritoneal fluids include the majority of resistance phenotypes (75% of ESBLs, 100% of carbapenemases and 100% of MRSAs). Of 35 pathogens isolated from peritoneal puncture fluids, the most common bacterial strains were *Enterobacteriaceae* with 33.7% ESBL 33.7% of *K. pneumoniae* and 6.8% *E. coli* [7]. Isolated staphylococci were resistant to penicillins G. Among them, 17% is MRSA. As reported on clinical samples from five African cities, there is a prevalence of more than 15% of MRSA on the continent [37].

Susceptibility Profile of Bacterial Strains Isolated from Joint Fluid: The most common strains in joint fluid were methicillin-sensitive staphylococci. No MRSA has been isolated from this pathology. In literature, Trifa *et al.* reported in Tunis, 59% of *S. aureus* methicillin-susceptible during osteoarticular infections in children. However, the same team reported 12% resistance to methicillin [15].

Antibiotics active on isolated bacterial strains: Some studies suggested the standardization of an effective antibiotic therapy on the main pathogens involved in pleurisy. Indeed, in their work, the probabilistic treatment was based on the combination of a beta-lactam associated with an aminoglycoside or a macrolide [11] [13]. We believe that in this combination, beta-lactam must be a 3rd generation carbapenem or cephalosporin due to the low sensitivity of other cephalosporins. However, empiric antibiotic therapy in paediatric peritonitis is of-

ten penicillin + inhibitor-based monotherapy (ampicillin + sullbactam/piperacillin + tazobactam) or ertapenem. Unfortunately, more than 38% resistance to ampicillin + sullbactam has been reported [27]. According to the work of Lob *et al*., only imipenem and amikacin had greater than 90% sensitivity in peritonitis [7]. However, the recommendation of monotherapy with penicillin plus inhibitors or carbapenems remains unlikely because of ESBL-producing strains..

The initial therapeutic choice is empirical in osteoarticular infections. Despite decades of experience with numerous and diverse protocols, the analysis of clinical studies does not determine the best antibiotics for osteoarticular infections. An association is required. Primary treatment may be a combination of penicillin-resistant penicillinase and a third-generation cephalosporin. An alternative therapy is the combination of vancomycin, fosfomycin, rifampicin or clindamycin with a third-generation cephalosporin [39].

We can notice that effusion fluids make the patient uncomfortable. The best way to avoid them is to eliminate the etiologies of the effusion. This could be done towards the treatment of the diseases. Similarly, we don't have any information about the influence of local weather on the fluids effusion infection. Nevertheless, these infections are commonly found in diseases as cancers particularly in T-lymphoblastic lymphoma even it is a rare subtype of non-Hodgkin lymphoma [40]. Elsewhere, many cases of fluids effusion are observed in some inflammatory diseases like polyserositis. Then, it can be observed some cases of neoplasm with an increase level of pleural lactate deshydogenase [41]. Moreover, some studies had shown that the abnormal effusion fluid were observed in auto-immune diseases [42]. Finally, some unknown etiologies cases are described with effusion fluids [41]. Despite these limitations, we were able to study the bacteriological profile of effusion fluids.

5. Conclusions

This study allowed us to analyze the bacteriological profile of the effusion fluid in a pediatric setting. This analysis showed a microbial polymorphism with a higher proportion of *E. coli* and *S. aureus* in general. We found a predominance of *E. coli* and *S. aureus* in the pleural fluid, mainly *E. coli* in the peritoneal fluid and a high frequency of *S. aureus* in the joint fluid. Culture of the pericardial fluid did not identify a pathogen.

Antibiotics susceptibility testing identified several resistance phenotypes. ESBL was present in one-third of the *Enterobacteriaceae* as well as an emergence of carbapenemases. In addition, one-tenth of the isolated *S. aureus* were MRSA. The most sensitive antibiotics on Gram-positive cocci were cefoxitin, aminoglycosides, and macrolides. For Gram-negative bacilli, imipenem, aminoglycosides, chloramphenicol and nitrofurans were active. Ultimately, probabilistic antibiotics therapy could be a combination of antibiotics and will be done according to the pathological product. This treatment should be done taking into account the pharmacodynamics and pharmacokinetics of these antibiotics. This probabilistic

antibiotics therapy will be secondarily adapted according to the results of the susceptibility test.

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Conflicts of Interest

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

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Annex

SOS
MINISTERE DE LA SANTE
SECRETARIAT GENERAL

BURKINA FASO
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DIRECTION DES RESSOURCES HUMAINES

15 MAI 2020

N°2020-979/MS/SG/CHUP-CDG/DG/DRH/SOS

Ouagadougou, le

La Directrice Générale

A

Monsieur **TIENDREBEOGO Salam**
Etudiant en master II de bactériologie-virologie
Téléphone : **70-51-66-69/78-70-71-32**

Objet : Autorisation de collecte de données.
Réf : VD du 07/05/2020

J'accuse réception de votre demande dans laquelle vous sollicitez une autorisation de collecte de données dans le cadre de l'élaboration de votre mémoire de fin d'étude en Master II de bactériologie-virologie dont le thème est : « ***profil bactériologique des liquides d'épanchement au CHUP-CDG de 2015-2019*** ».

Par la présente, je vous informe que je marque mon accord pour la réalisation de ladite enquête dans le respect de l'éthique dans notre établissement.

Pour les modalités pratiques, vous voudriez donc prendre attache avec Madame le ***Professeur Rasmata OUEDRAOGO, Chef de Service des laboratoires.***

Je vous informe par ailleurs qu'au terme de votre travail, vous avez l'obligation de déposer deux (02) exemplaires du document à la bibliothèque du CHUP-CDG.

Tout en vous souhaitant bonne réception, recevez Monsieur, mes sincères salutations.

Cyrille Priscille KABORET/OUEDRAOGO
Chevalier de l'Ordre National
Médaille d'Honneur de Collectivités locales

Ampliations :
1-DRH
1-SRF
1-Sces des Laboratoires
1-Intéressé
1 Chrono