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Spontaneous Bacterial Peritonitis and Short-Term Prognosis in a Group of Decompensated Cirrhotic Patients in Yaounde: A Cross-Sectional Study

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Abstract

Introduction: Spontaneous bacterial peritonitis (SBP) is among the most common infections in cirrhotic patients. Data on SBP are rare in Cameroon. This prompted us to carry out this study on patients with decompensated cirrhosis of the liver in Yaounde University Hospital Centre (YUHC). **Methods:** We carried out a cross-sectional study from December 2015 to June 2016 in three units of YUHC. All patients with decompensated liver cirrhosis were included. Our sampling was consecutive. Diagnosis of cirrhosis was performed, based on clinical, biological and ultrasound criteria. A neutrophil count greater than 250 cell/mm^3 in ascites fluid defined an SBP. Data on socio-demography, clinical presentation, and outcomes were collected. **Results:** We included 34 decompensated cirrhotic patients (15 males). Patients mean age was 57.5 ± 2 years (SBP positive: 48.7 ± 21.3 versus without SBP: 59.8 ± 19.5, p = 0.22). SBP diagnosis was made in 6 (17.7%) patients. Compared to patients with decompensated liver cirrhosis and without SBP, positive SBP patients had a higher pulse rate (p = 0.002) and respiratory rate (p = 0.02). The patients with SBP were more likely to present these other clinical fea-

tures: pulse rate >100 (RR: 4.2, [95% CI: 0.7 - 27.7]; p = 0.02), presence of jaundice (RR: 3.4, [95% CI: 0.6 - 21.1]; p = 0.09), being from female gender (RR: 3.2, [95% CI: 0.5 - 19.9]; p = 0.11), advanced liver disease (Child C class) (RR: 2.4, [95% CI: 0.4 - 14.5], p = 0.66), low-plasma albumin (less than 20 g/L) (RR: 1.7, [95% CI: 0.8 - 3.9], p = 0.08), respiratory rate > 30 (RR: 1.6, [95% CI: 0.6 - 3.3], p = 0.05) and fever/hypothermia (RR: 1.5, [95% CI: 0.6 - 3.4]; p = 0.22). Evolution after a 72-hours antibiotherapy was stationary in four cases and unfavorable in two patients, resulting in death. **Conclusion:** SBP prevalence was 17.7%. SBP patients were younger, from female sex, tachycardia and polypnea, presenting with fever/hypothermia and signs of advanced liver disease than non-SBP patients. Improvement of our technical platform will be useful to determine the cause of cirrhosis and identify the different germs responsible for SBP.

Keywords

Spontaneous Bacterial Peritonitis, Decompensated Liver Cirrhosis, Sub-Saharan Africa

1. Introduction

Previously assumed to be the ultimate evolution of all chronic hepatic diseases after years of progression, liver cirrhosis is nowadays considered as a pathological process with potential for progression or regression of hepatic fibrosis [1] [2] [3]. It is defined as an irreversible hepatic architecture impairment resulting from progressive fibrosis and characterized by the development of regenerating nodules and a chronic, sustained inflammatory response [4]. Chronic liver disease (CLD) with or without cirrhosis is a public health problem worldwide affecting 844 million people with 2 million annual deaths [5]. Cirrhosis prevalence and mortality are still high in Western countries, responsible for 170,000 and almost 66,000 yearly deaths respectively in Europe and the United States. CLD in these countries is mostly due to nonalcoholic fatty liver disease (NAFLD), alcoholic liver disease (ALD) and viral hepatitis C (VHC) [5] [6] [7]. In sub-Saharan Africa, cirrhosis of the liver mortality is still high and viral hepatitis B and C are the main etiology [8] [9]. There, liver cirrhosis is lately diagnosed, leading to high frequency of these complications [10]. Infections are among the most frequent complications in cirrhotic patients [11]. Spontaneous bacterial peritonitis (SBP) is one of the most common infections among Western cirrhotic patients and associated to a poor prognosis [12] [13] [14]. It is defined by a polynuclear count in ascites fluid greater than 250 cells/mm^3 [13]. Its importance is related to its prevalence and its complications (decompensation, encephalopathy, death) [15] [16]. In fact, its presence is a prognostic factor in the course of cirrhosis of the liver [12] [17] [18] [19]. Previous studies suggest more than 10% to 30% of admitted patients and 3.5% of outpatients with cirrhosis and ascites have SBP

[20] [21] [22]. In Western countries, many factors have identified to be associated with the risk of developing SBP in cirrhotic patients. These factors include upper gastrointestinal bleeding, poor liver function, low ascitic fluid protein levels, prior SBP and hospitalization [23]. Dia *et al.*, in 55 patients in Senegal, found an SBP prevalence of 27%. SBP was associated with female gender, leukocytosis and cloudy appearance of ascetic fluid [24]. Bathaix *et al.*, in a series of 221 patients, in Ivory Coast, identified SBP as prognosis factor in univariate [17]. In a more recent study in Ghana, Duah and Nkrumah found an SBP prevalence of 25.24% among 103 cirrhotic patients. Ascites fluid was positive only in 9 patients, with *E. coli* the common pathogen [25].

Data on SBP are scanty, even rare in Cameroon [26]. This cross-sectional study aimed at characterizing the epidemiological, clinical, bacteriological and outcome specificities of SBP in a group of cirrhotic patients in Yaounde.

2. Methodology

2.1. Study Design and Setting

This cross-sectional study was carried out in the emergency and internal medicine units of University Teaching Hospital. This is a tertiary hospital in Yaounde, the capital city of Cameroon (SSA).

2.2. Study Population

Patients admitted for decompensated liver cirrhosis were prospectively recruited from December 2015 to June 2016. Cirrhosis diagnosis was based on clinical, biological, ultrasound and endoscopic signs of portal hypertension and/or hepato-cellular insufficiency. Decompensated liver cirrhosis was defined by the presence of jaundice and/or hepatic encephalopathy and/or ascites and/or edema and/or variceal hemorrhage. The patients excluded were those on antibiotics or who had received antibiotics within 15 days, those who had an ascites fluid tap and/or invasive abdominal procedures (surgical or endoscopic) within 30 days and those presenting clinical signs of another infection site.

2.3. Variables and Measurements

The data were collected on socio-demography (age, sex, profession and risk factors for chronic liver disease), clinical (abdominal pain, fever, neurologic disorders, blood pressure, pulse, respiratory rate and hepato-cellular failure or/portal hypertension signs), analysis of ascites fluid tap, and outcomes (72 h antibiotherapy response, survival or death) using a standardized questionnaire. The sampling was consecutive. Risk factors for liver cirrhosis recorded were hepatitis B, C and D status, at risk of alcohol intake (>30 g/day for women and 40 g/day for men), known chronic liver disease). Cirrhosis complications such as altered renal function, hepatic encephalopathy, hepato-cellular carcinoma or variceal hemorrhage were also recorded. Three sterile samples (15 ml) of ascites fluid were collected for each patient for biochemical (albumin, sugar dosages) and bacteri-

ological (cellular count, staining and cultures) studies. SBP was defined as neutrophils count in the ascites fluid greater than 250 cells/mm^3. Bacterial culture was performed to identify microorganisms. Other work-ups included the research of biological stigmas for hepato-cellular failure and portal hypertension included dosage of prothrombin time, serum albumin, total plasma bilirubin and full-blood count. All patients diagnosed for SBP were treated by intravenous levofloxacin 500 mg/day in association with intravenous metronidazole 1500 mg/day. The 72-hour antibiotherapy response was recorded. Partial or complete clinical improvement (fever/hypothermia and/or abdominal pain and/or ascites volume reduction) with absence of complications (digestive hemorrhage or hepatic encephalopathy) and/or reduction in PNN count by at least 25% defined favorable evolution. Stationary evolution was defined by absence of clinical improvement without complications regardless of PNN count. An unfavorable evolution was defined by worsening of clinical signs or death.

2.4. Sample Size and Statistical Analysis

A consecutive sample of all eligible cases was considered for this study. Data were analyzed using the software EPI info 3.5. Discrete variables have been presented as counts and percentages, and continuous variables as mean (standard deviation). Chi-squared test, Student t-test was used, and ANOVA were appropriate. The relative risk was calculated for each parameter studied in those having SBP compared to those that did not. A p value < 0.05 was considered significant for the observed differences or associations.

2.5. Ethical Consideration

This work was approved by the Institutional Review Board of the Higher Institute of Medical Technology of Yaounde. Administrative authorization from Yaounde University Hospital Centre was obtained. This work was carried out in accordance with the declarations of Helsinki and it was reported following the STROBE checklist.

3. Results

Participants: on 44 eligible cirrhotic patients, only 34 were included (10 patients were excluded because they did not perform the ascitic fluid tap). On those 34 patients, 19 (55.9%) were females, and diagnosis of SBP was made in 6 (17.7%) patients. Their mean age was 57.8 ± 20.0 years (SBP 48.7 ± 21.3 years versus non-SBP: 59.8 ± 19.5 years, $p = 0.22$). The ≥60-year age group was the most frequent-18 (52.9%) patients. Among SBP positive patients, 5 were females and so the female had greater risk of having SBP (RR: 3.2, [95% CI: 0.5 - 19.9], $p = 0.11$).

Bacteriological culture was positive only in one patient revealing *Klebsiella pneumonia*. Total leucocytes (SBP 2223 VS without SBP 243, $p < 0.001$) and polynuclear count (SBP 690 VS without SBP 26, $p < 0.001$) in ascites fluid were significantly different between patients with SBP and without SBP.

Hypertension (26.5%), diabetes (11.8%) and HIV infection (8.8%) were the most common co-morbidities. More than half (58.8) of patients were already known to have cirrhosis of the liver. Cirrhosis of the liver etiology was chronic viral hepatitis in 26 (76.5%) patients, alcohol related in 3 (8.8%) and mixed etiology (viral and alcohol-related) in 4 (11.8%). One patient had a primary biliary cirrhosis. Patients were classified Child Pugh C in 18 (53%) cases and Child Pugh B 16 (47%) cases. Altered renal function was found in 11 (32.4%) patients and hepatic encephalopathy was seen in 5 (14.7%) patients. Characteristics of patients at inclusion are summarized in Table 1.

In univariate analysis, higher pulse rate (p = 0.002) and higher respiratory rate (p = 0.02) were common in SBP patients comparatively to non-SBP patients. Patients with SBP were more likely to present these other clinical features: pulse rate >100 (RR: 4.2, [95% CI: 0.7 - 27.7]; p = 0.002), presence of jaundice (RR: 3.4, [95% CI: 0.6 - 21.1]; p = 0.09), being from female gender (RR: 3.2, [95% CI: 0.5 - 19.9]; p = 0.11), advanced liver disease (Child C class) (RR: 2.4, [95% CI: 0.4 - 14.5], p = 0.66), low-plasma albumin (less than 20 g/L) (RR: 1.7, [95% CI: 0.8 - 3.9], p = 0.08), respiratory rate > 30 (RR: 1.6, [95% CI: 0.6 - 3.3], p = 0.05) and fever/hypothermia (RR: 1.5, [95% CI: 0.6 - 3.4]; p = 0.22) (Table 2).

Table 1. General characteristics of study population.

Variables	Frequency (%)
Gender	
Male	15 (44.1)
Female	19 (55.9)
Age group	
20 - 40	10 (29.4)
41 - 60	7 (20.6)
61 - 80	16 (47.1)
>80	1 (2.9)
Co-morbidities	
Hypertension	9 (26.5)
Diabetes	4 (11.8)
HIV infection	3 (8.8)
Cirrhosis of the liver aetiology	
Chronic viral hepatitis	26 (76.5)
Alcohol-related	3 (8.8)
Mixed (viral hepatitis and alcohol)	4 (11.8)
Primary biliary cirrhosis	1 (2.9)

Table 2. Characteristics of cirrhotic population with or without SBP.

Variables	SBP (N = 6)	Non SBP (N = 28)	RR (95%CI)	p-value
Age (Mean)	48.7 ± 21.3	58.8 ± 19.5	NA	0.22
Female sex	83.3%	50%	**3.2** (0.5 - 19.9)	0.11
Fever/hypothermia	50%	25%	**1.5** (0.6 - 4.4)	0.22
Jaundice	83.3%	42.9%	**3.4** (0.7 - 21.1)	0.09
Abdominal pain	66.7%	60.7%	1.1 (0.3 - 4.0)	0.58
Hepatic encephalopathy	33.3%	10.7%	1.3 (0.7 - 4.0)	0.2
Pulse rate (PR)	115.3 ± 11.6	95.6 ± 13.6	NA	**0.002**
PR > 100	83.3%	35.7%	**4.2** (0.7 - 25.7)	**0.02**
Respiratory rate (RR)	33.5 ± 14.6	24.4 ± 6.2	NA	**0.02**
RR > 30	50%	10.7%	**1.6** (0.7 - 3.7)	0.05
Glasgow Coma scale	14.7 ± 0.8	14.8 ± 0.8	NA	0.82
Systolic arterial pressure (mean)	116.6 ± 23.6	121.5 ± 22.4	NA	0.63
Ascitic fluid				
Albumin (g/L)	24.3 ± 15.5	26.5 ± 16.2	NA	0.76
Alb < 15	50%	28.6%	1.4 (0.6 - 3.3)	0.29
Leucocytes count (/mm^3)	2223 ± 3645	242.9 ± 473	NA	**<0.001**
Polynuclear count (/mm^3)	689.5 ± 1065	25.9 ± 38	NA	**<0.001**
Prothrombin ratio (PR)	43.2 + 31.6	57.1 ± 22.6	NA	0.21
PR < 50	50%	32.1%	1.4 (0.6 - 3.1)	0.35
Plasma albumin (Alb) (g/L)	21.5 ± 4.5	28.7 ± 13.2	NA	0.2
Alb ≤ 20	50%	14.3%	**1.7** (0.8 - 3.9)	0.08
Bilirubin (mg/L)	66.3 ± 58.3	51.5 ± 55.8	NA	0.56.
Bil ≥ 55	50%	28.6	**1.4** (0.6 - 3.1)	0.36
Creatinin	15.1 ± 7.1	12.4 ± 3.2	NA	0.15
Child C	66.7%	50%	**2.4** (0.4 - 14.5)	0.66

In patients diagnosed for SBP, the evolution after a 72-hour antibiotherapy was stationary in 4 cases and unfavorable in 2 cases resulting in death. Mortality rates of SBP was 33% Death occurred within 7 days of antibiotherapy.

4. Discussion

SBP have not been extensively studied in Africa. Few studies, especially on the prevalence, risk factors and treatment of SBP have been carried out in Africa

[17] [20] [24] [26] [27] [28] [29] [30]. However, data are still lacking particularly in sub-Saharan Africa.

This study should be interpreted in the light some limitations. The sample size of participants was small due to the short time data collection. Just few patients have been recruited during the study period, thus reducing the capacity to detect significant correlations. Another problem was the technical platform for performing good bacteriological cultures. Despite these limitations, this study is one of the first published in Cameroon on the SBP and brings some interesting data, which will be discussed below.

SBP prevalence was 17.7% in the study. It is higher than 11.88% found by Noah et al. in Douala, but lower than the 24.67%, 27% and 27.7% found respectively in Nepal, Côte d'Ivoire and Senegal [17] [24] [26] [27] [28]. This difference in SBP prevalence could be related to infectious exposure, which must be higher than in Western countries but lower than in Asia and West Africa. The definition criteria of SBP were the same for all studies. Positive ascites culture defined certain SBP. In the absence of culture, SBP diagnosis was probable [22] [23] [26].

Female predominance has been found in this study. Most studies present a male or no gender predominance [24] [26] [27] [28]. The female predominance can be related to greater use of health facilities by women in Cameroon or a selection bias. Risk for SBP was increased among females as Dia *et al.* finding due to increased women's health frequentation [24]. Population mean age was similar to Noah's findings [26]. In fact, patients with SBP were younger (not significantly) than those without SBP in many studies [24] [27] [28]. However, an increase would have been expected in SBP prevalence with age.

Patients with SBP were more likely to present particular clinical and paraclinical features including pulse rate > 100, respiratory rate > 30, presence of jaundice, plasma albumin less than 20 g/L, female sex, fever/hypothermia and Child class C. Most of those items (plasma albumin, jaundice, hepatic encephalopathy, Child C class) correlate with the severity of liver disease, which is known to be associated to SBP occurrence [30] [31] [32]. Increased pulse rates, high respiratory rate and fever seem to be the glance of infection. Fever/hypothermia has been reported associated with SBP but no study has looked for association with tachycardia and tachypnea [28] [33]. As expected, leucocytes count and polynuclear count in ascites fluid were higher in SBP patients [24] [26] [27] [28]. Albumin in ascites fluid was higher than 10 g/L for all SBP patients. Proton pump inhibitors consumption is known to be associated with SBP but it was not checked in this study.

Outcome was poor in our setting with no favorable antibiotherapy response for all patients and 33.3% of intra-hospital mortality. In this context, it was difficult to make any correlation between antibiotherapy response and patient characteristics. This mortality was similar to Dia findings but higher than Asian and European results [24] [28] [34]. Patients in this study died in the context of

worsening of hepatic encephalopathy. High mortality rates in low-income countries could be related to management issues in adjunctive treatment of SBP (endoscopic treatment of variceal hemorrhage or albumin perfusion).

5. Conclusion

Prevalence of SBP was 17.7% among our cirrhotic population. SBP patients were more likely to be younger, from female gender, with tachycardia and polypnea, fever/hypothermia and signs of advanced liver disease than non-SBP patients. Mortality rate was 33.3%. The identification of germs responsible for SBP in our setting associated to their sensitivity to different antibiotics could be useful in reducing mortality due to SBP in Cameroon.

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Authors' Contribution

Conception and Design: MPK, NKWN; Data collection: NKWN, MPK, LPD, HGK; Data analysis and Interpretation: NKWN, SRSN, MPK; drafting of the manuscript: SRSN, MPK. All the authors read and approved the final manuscript for publication.

Availability of Data

Data are available on request from the corresponding author.

Conflicts of Interest

The authors declare that they have no competing interest.

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