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Spontaneous Bacterial Peritonitis in Egyptian and Saudi Patients with Liver Cirrhosis

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Abstract. The aim of this study is to investigate spontaneous bacterial peritonitis in Egyptian and Saudi patients with liver cirrhosis and changes of their laboratory indicators in assisting with in their diagnosis and treatment. Seventy Egyptian and Saudi cirrhotic patients with spontaneous bacterial peritonitis and 30 patients with liver cirrhosis alone were investigated. In addition to liver function tests, ascitic fluid specimens were investigated for cytological, biochemical and bacteriological changes. Results revealed that 12 (17.1%) of spontaneous bacterial peritonitis patients showed culture-negative neutrocytic ascites, while 58 (82.9%) patients were culture-positive. Hence, their occurrence was more frequent in old male patients without significant difference regarding the nationality. These patients presented with fever, abdominal pain, high activity of liver enzymes and high serum levels of bilirubin and low of proteins; albumin and glucose. Their ascitic fluids showed a high polymorph nuclear cell count > 250 cells/mm^3. Microorganisms isolated were Enterobacteriaceae (*e.g. Escherichia coli*, *Klebsiella pneumoniae*, and *Proteus mirabilis*), *Staphylococcus-aureus*, *Staphylococcus epidermidis* and *Enterococcus faecalis*. Blood culture bottle method showed more positive result than that obtained by conventional culture method. Most of the isolated microorganisms showed sensitivity to Cefotaxime while *Enterococcus faecalis* showed sensitivity to meropenem.

Keywords: Spontaneous bacterial peritonitis, Liver cirrhosis, Blood and conventional culture methods.

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Introduction

Spontaneous bacterial peritonitis (SBP) is one of the most frequent and severe complication of liver cirrhosis (LC) in patients with ascites which occurs in 10-30% [1]. SBP is defined as an infection of ascitic fluid (AF) without a detectable source of infection which classically occurs in patients with decompensates cirrhosis due to the defect in the host defense mechanism. SBP results from translocation of enteric bacteria across gut wall or lymphatic and is usually presented by fever, diffuse abdominal pain and tenderness, but in some cases they are asymptomatic[2].

Diagnosis of SBP can be determined by cytological and bacteriological examination of AF. Polymorphonuclear cell (PMN) counts greater than 250 cell/mm^3 in AF is considered an indication for the presence of SBP. AF culture is important for diagnosis of SBP and for knowing the causative microorganisms, and the proper selection of antimicrobials treatment. It has been shown that the detection of the causative microorganisms of SBP in AF by conventional culture method (CCM) is difficult and is negative in more than 60% of the cases, even in the presence of clinical manifestations[3]. Therefore, culture technique of the AF by using blood culture bottle method (BCBM) is essential for the diagnosis of SBP. It is used for culturing of the collected AF allowing an increase of the chance of obtaining a positive culture up to 90%[4]. Culture-negative neutrocytic ascites (CNNA) is a sterile AF, where bacterial infection is not detected by culturing and only an increased number of PMN above the limit of 250 cells/mm^3 is diagnostic. However, symptoms and course of the disease are similar in SBP and CNNA patients[5].

It has been reported that most of cases of SBP are caused by Gram-negative enteric bacilli such as *E. coli* and *Klebsiella pneumoniae*[6]. While, some cases are induced by Gram-positive cocci such as Staphylococci and Enterococci[7]. Empiric antibiotic therapy, *e.g.* an intravenous third-generation of cephalosporin, preferably Cefotaxime should be started as soon as possible without delay even before knowing the result of culture[8].

Few studies have been performed regarding SBP in Egypt or in Saudi Arabia. However, a report about SBP in Saudi patients in the Gizan region was published[9]. It comprised 115 patients with non-alcoholic LC

and 40% of them were complicated by SBP. Therefore, the aim of this report is to study SBP among Egyptian and Saudi patients with LC, their laboratory changes, methods of bacteriological isolation and their sensitivity to commonly used antimicrobial agents.

Subjects and Methods

Patients

This study included 70 patients with LC complicated by SBP and 30 patients with LC alone. Egyptian and Saudi patients with different ages and genders were selected from different hospitals at Menofia Governorate in Egypt and from different hospitals at Jeddah city in the Kingdom of Saudi Arabia. These patients were exposed to a complete history inquiry, thorough clinical examinations, and laboratory investigations. These included a complete blood picture, serum Alanine transaminase (ALT), Aspartate transaminase (AST), gamma glutamyl transaminase (GGT), alkaline phosphatase (ALP), total protein, albumin, and bilirubin. Other biochemical parameters, in addition to viral markers for the presence of HBsAg, HBcAb, HCVAb and HCV-RNA were considered. Diagnosis of LC was based on ultrasonography and abdominal triphasic CT and liver histopathology. SBP diagnosis was based on AF culturing by conventional and blood culture bottle methods and on the presence of PMN cell count ≥ 250 cells/mm^3.

Methods

Liver Function Tests (Lfts) and Other Blood Chemistry Parameters

ALT, AST, GGT, ALP, total protein, albumin and bilirubin plus other biochemical parameters were assayed by using commercial reagents kits from Randox Laboratories Ltd (Diamond Road, Crumlin Co, UK). Viral markers for the presence of HBsAg, HBcAb, HCVAb in the serum were detected by ELISA and presence of HCV-RNA were detected by nested RT-PCR (Promega Co. MA, USA).

Ascitic Fluid (AF)

Paracentesis was done by drawing 50 ml of AF from each patient under strict aseptic condition. An aliquot of AF was used for WBCs and PMNs counts as well as for the determination of glucose, total protein, albumin, and lactic dehydrogenase (LDH) levels by commercial kits. Another aliquot was used for bacteriological study.

Bacteriological study according to Jyostna and Malathi (2009)[10].

AF Staining

AF films were stained by Gram-stain for detection of Gram-positive and -negative microorganisms.

AF Culturing

1. *Conventional Culture Method (CCM)*

The centrifuged AF deposit was inoculated on nutrient, blood, and MacConkey's agar plates and was incubated aerobically and anaerobically at 37°C for 2 days. The growing colonies were identified by the standard microbiological methods.

2. *Blood Culture Bottle Method (BCBM)*

Five ml of AF were cultured by BCBM at patient's bed-side; the bottles were incubated at 37°C and were examined for growth at least for 7 days. Subcultures were done on nutrient, blood and MacConkey's agar plates. These plates were incubated aerobically and anaerobically at 37°C for 2days. The growing colonies were identified by the standard microbiological methods

Antimicrobial Sensitivity Test

After identification of the isolated microorganisms, sensitivity tests were performed against the commonly used antimicrobial agents according to the Clinical and Laboratory Standards Institute (CLSI) recommendation for disk diffusion[11].

Results

Table 1 shows that of the 70 SBP patients evaluated, 52 were males and 18 were females with mean age 57.74 ± 7.90 years. Moreover, of the 30 LC patients examined, 21 were males and 9 were females with mean age 45.25 ± 10.38 years with significant difference. Regarding the nationality no significant difference was found among Egyptian and Saudi populations. The presenting symptoms were fever, abdominal pain and tender abdomen in 51 (73%), 66 (94%) and 66 (94%), respectively in SBP patients. However, symptoms were not manifested in LC patients with significant difference. Hepatic encephalopathy was observed in 16 (23%) of SBP patients compared to 6 (20%) of LC patients without significant difference.

Table 1. Demographic and clinical data of patient groups.

Parameters	SBP N = 70	LC N = 30	P-Value
Mean age (years) ± SD	57.74 ± 7.90	45.25 ± 10.38	S
Nationality: Egyptian / Saudi	37/33	16/14	NS
Gender: Male / Female Ratio	2.9 :1 (52/18)	2.3 :1 (21/9)	S
Fever Present Absent	 51 (73%) 19 (27%)	 0 100 (100%)	S
Abdominal pain Present Absent	 66 (94%) 4 (6%)	 0 100 (100%)	S
Tender abdomen Present Absent	 66 (94%) 4 (6%)	 0 100 (100%)	S
Hepatic encephalopathy Present Absent	 16 (23%) 54 (77%)	 6 (20%) 24 (80%)	NS

S= significant difference, NS=non-significant difference

Table 2 shows the laboratory data of SBP and LC patients. Almost all parameters of liver function tests of SBP patients were significantly elevated compared to those of LC patients. The majority of patients showed HCV markers followed by HBV markers. While, 5.8% and 10% showed mixed viral infection of HCV and HBV, 11.4%, and 10% of cases did not have any viral markers among the SBP and LC groups, respectively.

Table 2. Laboratory data of the studied patient groups.

Parameters	SBP N = 70	LC N =3 0	P-Value
WBCs (N/mm^3)	17.037 ± 5112	5.850 ± 2795	< 0.0001
Total Bilirubin (mg/dl)	5.83 ± 2.25	3.65 ± 1.4	< 0.05
Direct Bilirubin (mg/dl)	4.18 ± 2.2	2.52 ± 1.75	< 0.05
Total protein (g/dl)	6.17 ± 0.71	6.87 ± 0.79	< 0.05
Albumin (g/dl)	1.91 ± 0.55	2.75 ± 0.71	< 0.05
AST (U/L)	97.5 ± 68	79.05 ± 65.9	< 0.05
ALT (U/L)	85.75 ± 44.38	64.55 ± 54.2	< 0.05
GGT (U/L)	65.22 ± 32.24	52.95 ± 17.2	< 0.05
ALP (U/L)	114.87 ± 43.1	100.7 ± 37.6	< 0.05
Prothrombin Time (Second)	18.43 ± 4.69	15.81 ± 4.06	< 0.01
Prothrombin Concentration (%)	52.62 ± 18.81	69.81 ± 22.39	< 0.01
Viral Markers HCV (Antibodies and RNA) HBV (HBsAg and HBcAb) Mixed Infection (HCV and HBV) Negative	 50 (71.4%) 8 (11.4%) 4 (5.8%) 8 (11.4%)	 20 (66.7%) 4 (13.3%) 3 (10%) 3 (10%)	**NS**

Values are expressed as mean ± SD. P-value < 0.05 was considered significant

Table 3 indicates an elevation of WBCs (N/mm^3), PMNs, (N/mm^3) and LDH. It showed lowering of the total protein, albumin and glucose in SBP patients compared to those of LC patients respectively with a significant difference indicating infection of the AF of the former.

Table 3. Characters of ascitic fluid in the studied patient groups.

Parameters	SBP N=70	LC N=30	P-value
WBCs (N/mm^3)	1.444 ± 760	329 ± 169	< 0.0001
PMNs (N/mm^3)	364 ± 69	101 ± 50	< 0.0001
Total protein (g/dl)	1.02 ± 0.38	2.53 ± 0.75	< 0.0001
Albumin (g/dl)	0.34 ± 0.23	1.2 ± 0.52	< 0.0001
Glucose (g/dl)	95.75 ± 32.19	131.1 ± 18.86	< 0.0001
LDH (IU/L)	197.84 ± 113.5	95.27 ± 32.4	< 0.0001

Values are expressed as mean ± SD. P-value < 0.05 was considered significant

Table 4 shows that the AF samples were positive by both culturing methods, but the BCBM showed a more positive result [58 out of 70 cases (82.9%)] than that obtained by [CCM 30 out of 70 cases (42.9%)]. Therefore, indicating that the former method was more sensitive than the latter.

Table 4. Comparison between conventional culture and blood culture bottle methods of ascitic fluid.

Culture method	Cases (No)	+ve growth	-ve growth	Sensitivity (%)
Conventional culture method	70	30 (42.9%)	40 (57.1%)	42.9
Blood culture bottle method	70	58 (82.9%)	12 (17.1%)	82.9

Chi-square test (χ^2) was used for comparison, p value < 0.001, when comparing BCBM with the conventional culture method.

Table 5 shows that AF parameters of protein, albumin and glucose were significantly lower among the positive culture cases while; WBCs, PMNs and LDH were significantly higher compared to the corresponding results among the negative culture cases.

Table 5. Comparison between positive and negative ascetic fluid growth by blood culture bottle method.

Parameters	Positive culture 58/70 (82.9%)	Negative culture 12/70 (17.1%)	P-value
WBCs (N/mm ^{3})	1.586.78 ± 583.3	759.16 ± 118.8	< 0.001
PMNs (cell /mm3)	381.3 ± 63.38	279.58 ± 12.51	< 0.001
Protein (g/dl)	1.1 ± 0.23	1.8 ± 0.45	< 0.001
Albumin (g/dl)	0.28 ± 0.5	0.59 ± 0.37	< 0.01
Glucose (g/ dl)	95.91 ± 30.6.	124.16 ± 29.97.	< 0.01
LDH (IU/L)	211.18 ± 117.46	133.33±62.55	< 0.01

Mann–Whitney (Z) test was used for comparison; p value was considered significant p < 0.001.

Table 6 indicates the different isolated microorganisms by using the CCM and the BCBM. The prevailing microorganisms found in the AF were *E. coli*, either by CCM or by BCBM followed by *Klebsiella pneumoniae* and *Proteus mirabilis*. Gram-positive cocci (*S. aureus, S. epidermidis* and *E. faecalis*) were detected by BCBM while, only *S. aureus* was detected by CCM, indicating that the former method is more sensitive.

Table 6. The isolated microorganisms from AF specimens by using blood culture bottle method and conventional culture method.

Microorganisms	Blood culture Bottle (58)		Conventional Culture (30)	
	Number	%	Number	%
E. coli	31	53	18	60
Klebsiella pneumoniae	8	14	6	20
Proteus mirabilis	4	7	2	7
S. aureus	8	14	4	13
S. epidermidis	2	3	0	0
Enterococcus faecalis	5	9	0	0

From the wide scale (25 types) of the investigated antimicrobial agents which were used against the isolated microorganisms (Gram-negative rods and Gram-positive cocci), nine of which (Cefotaxime, ceftazone, ceftazidime, ceftriaxone, tobramycin, amikacin, ampicillin, piperacillin and meropenem) showed various degree of sensitivity to these microorganisms as shown in Table 7. Cefotaxime showed the highest sensitivity to all tested microorganisms, except *E. faecalis,* which showed resistance to most of the tested antimicrobial agents yet; it showed various degrees of sensitivity to ampicillin, piperacillin and meropenem.

Table 7. Sensitivity of the isolated microorganisms (58) strains towards commonly used antimicrobial agents.

Antimicrobial Agents	*E. coli (31)*		*Klebsiella* (8)		*Proteus* (4)		*S. aureus* (8)		*S. epid.* (2)		*E. fecalis* (5)	
	S%	R%	S%	R%	S%	R%	S%	R%	S%	R%	S%	R%
Cefotaxime	100	0	100	0	100	0	100	0	100	0	0	100
Ceftazone	97	3	100	0	100	0	100	0	100	0	0	100
Ceftazdime	97	3	100	0	100	0	100	0	100	0	0	100
Ceftriaxone	97	3	88	12	100	0	100	0	100	0	0	100
Tobramycin	91	9	100	0	100	0	100	0	100	0	0	100
Amikacin	94	6	100	0	75	25	100	0	100	0	0	100
Ampicillin	45	55	50	50	75	25	50	50	80	20	80	20
Piperacillin	74	26	88	12	50	50	75	25	80	20	90	10
Meropenem	90	10	85	15	80	20	90	10	90	10	95	5

Discussion

Spontaneous bacterial peritonitis (SBP) is a bacterial infection of ascitic fluid (AF), which arises in the absence of any other source of infection within the peritoneum or adjacent tissues. The present study shows that SBP affects old ages more than the young. This result was similar to that reported by Albillos *et al.*(1990)[12] and Heo *et al.*(2009)[13]. Such results can be attributed to that elderly patients are more susceptible to infection due to decline of their immunity. Males were more commonly represented in this study than females; a result which was similar to that reported by Henz *et al.*(1995)[14]. They attributed these findings to the higher exposure of males to risk factors of liver diseases such as viral infections, smoking and drug addiction which they play a role in susceptibility and in the spreading of infection. Pessione *et al.(*2001)[15] reported that 66% of SBP patients had history of smoking. They reported that smoking can lead to an increase in the occurrence of fibrosis, and the activation of hepatic lesions in previously diseased liver, indicating that smoking may have a role in inducing hepatocellular damage. No significant difference was found among Egyptian and Saudi populations.

The main clinical manifestations of SBP were fever, abdominal pain, tenderness and hepatic encephalopathy. 73% of our SBP patients had fever and 94% had abdominal pain ($p < 0.0001$); a finding that was higher than that reported by other study[16]. Fever was correlated with the severity of peritoneal infection. This may be due to the release of endogenous pyrogen as IL-1 from phagocytes by many factors such as microbes and their products. IL-1 is carried by the blood stream to the thermoregulatory centers in the hypothalamus, where physiological responses are initiated and result in the occurrence of fever[17]. However, it has been reported that overt clinical manifestations of peritonitis were observed in only 20% of patients at the time of diagnosis [18]. This report was contradicted to our result, and this can be explained by the fact that SBP is a syndrome ranging in severity from fulminant to totally asymptomatic condition[19]. The present study showed that hepatic encephalopathy was present in 23%, and 20% of SBP and LC patients respectively without significant differences. On the other hand, Albillos *et al.*(1990)[12] and Heo *et al.*(2009)[13] found that the incidence of hepatic encephalopathy in SBP and LC patients was 36% and 27.4%,

respectively. These studies indicated that encephalopathy had no value in differentiating SBP from LC patients.

AF protein, albumin and glucose levels were significantly ($p < 0.001$) lower in SBP patients in comparison to those of LC patients. Romney *et al.*(2005)[20] reported that SBP was usually accompanied with low levels of AF protein and albumin. Thus, other parameters such as high serum bilirubin level are considered risk factors for prediction of developing SBP in cirrhotic patients with ascites. Furthermore, the low levels of AF protein and albumin were the most signifying parameters in differentiating SBP from LC.

Total serum bilirubin and direct bilirubin were significantly higher ($p < 0.01$) in SBP patients compared to LC patients and jaundice was apparent in both cases. This result was similar to that reported by Thanopoulou *et al.*(2002)[21] who found that high serum bilirubin was correlated with the risk of developing SBP ($p < 0.01$). Andreu *et al.*(1993)[22] and Wallerstedt *et al.*(2007)[23] reported that bilirubin level was the most relevant predictor of SBP among other liver function tests. Cirrhotic patients with high bilirubin level may be more susceptible to SBP due to severe chronic liver insufficiency and poor liver functions. However, Hurwich *et al.*(1993)[24] found no significant correlation between the severity of liver disease and the occurrence of SBP. They explained their finding by the using of small number of patients in their studies. Serum activity of AST, ALT, GGT and ALP were higher in the SBP compared with LC patients with significant difference and similar results were reported by Hoefs *et al.*(1982)[25]. These liver enzymes are considered as markers of hepatic inflammation rather than markers of synthesis; a fact which explains this finding. Prolonged prothrombin time and concentration in our patients may indicate that SBP mostly occurs with advanced stages of hepatic dysfunction as prothrombin concentration is a marker of the synthetic function of the liver[26]. Low prothrombin concentration and activity were considered predictors for the recurrence of SBP, and significantly associated with a high risk of SBP[27]. The peripheral leukocytosis in our SBP series may be a result of the associated inflammatory process which leads to elevated WBCs count in blood.

In the present study, the predominant viral markers were HCV markers (71.4%) which were higher than HBV markers (11.4%) among

SBP and among LC patients as they were (66.7%) and (13.3%) for HCV and HBV respectively. Such result was in basic agreement with previous report, but differed from other reports[29]. These results were expected due to high prevalence of HCV among patients with liver diseases associated with LC in our regions. Viral markers were not detected in (11.4%) of our SBP patients. A higher negative result was reported by Castellote *et al.*(2008)[28] who indicated that (40%) of SBP patients have no viral markers. The difference in these results can be attributed to the selection of patients and to the endemicity of the regions.

Cirrhotic cases with AF's PMN count more than 250 cells/mm^3 is considered SBP**[27]**. In our cohort of SBP patients, the PMN count (364 cells/mm^3) was significantly elevated ($p < 0.0001$) in comparison with LC (101 cells/mm^3). It is important to get a PMN count in order to initiate antibiotic treatment and to use an adequate culture technique [30]. PMN count played an important role in the diagnosis and in differentiating between SBP positive culture and SBP negative culture[31]. However, Jarcuska *et al.*(2004)[32] used PMN count of at least 500 cells/mm^3 for the diagnosis of SBP. Such high figure of PMNs count in AF occurs only in presence of infection, while any inflammatory process results in high WBCs count and because of the short survival time of PMNs; there is relative stability in their absolute count. The PMNs count was reported to be a reliable index of infection[33]. It has been reported that, the severity of SBP is defined by the presence of high PMN cell count in the ascites, and to the severity of liver functions[34]. Lipka *et al.*(1999)[35] showed that the only significant predictor of mortality was the peritoneal fluid PMN cell count, and a PMN count over 1000 cells/mm^3 was associated with a mortality of 88%. Our results were consistent with what had been reported by Andreu *et al.*(1993)[22] and Chang *et al.*(2001)[36] who indicated that decreased AF total protein and albumin were major risk factors for SBP. Cirrhotic patients with AF total protein $\leq$ 1gm/dl were found to develop SBP more frequently[37]. This may be attributed to the decreased synthetic function of liver cells which also leads to decreased levels of AF's complement components and the decreased opsonization of bacteria. Our data confirmed and supported the work of Gokturk *et al.*(2010)[38] who showed a low level of AF's glucose which, may be attributed to its consumption by bacteria and neutrophils during the course of infection. Thus, this can be considered as a good marker for diagnosis of SBP in addition to other changes of the

AF parameters. However, Garcia-Tsae *et al.*(1985)[39] and Badr *et al.*(1995)[40] reported that measurement of AF glucose showed no significant difference between sterile and infected ascites. The peritoneal membrane is quite permeable to large molecules and is frequently quite voluminous. These factors may serve to minimize the alteration in AF glucose during infection (Runyon and Hoefs, 1984)[31]. Our result showed that AF's LDH level was significantly higher in SBP and this can be attributed to its release from neutrophils. However, LDH level in SBP has low specificity in diagnosis. Measurement of glucose, protein and LDH may be used in the differentiation between SBP and peritonitis. It has been shown that, polymicrobial infection with glucose level < 50 mg/dL, protein level > 1.0 mg/dL, and above normal lactic dehydrogenase levels suggest secondary bacterial peritonitis, rather than SBP[41].

Our study demonstrated that BCBM at the patient's bed-side was more sensitive (82.9%) in diagnosis of SBP than the CCM (42.9%). Therefore, the use of BCBM improved the sensitivity of diagnosis, and this result had been supported and confirmed by previous reports[42-44]. The higher sensitivity of the BCBM is because it allows growth of low concentration of bacteria encountered in SBP while, the CCM was designed to detect bacteria in the setting of high colony count. Therefore, it was insensitive in detecting low colony count in SBP. This variation may be due to differences in the medium contained in the used bottles as blood culture media were formulated to support and provide good nutrients for bacterial growth, and multiplication, additionally, the medium contains anticoagulant and opsonin inhibitor which they protect bacteria from killing. Therefore, bacteria would be expected to grow rapidly in such an environment. However, Bobadilla *et al.*(1989)[45] concluded that this difference was not due to the medium composition itself, but rather due to difference in the microaerophilic environment supplied by thioglycolate. Despite the sensitivity of BCBM in diagnosis of SBP nonetheless, it failed to detect bacteria in at least 12 cases (17.1%) which were to be diagnosed clinically. Thus, they were associated with high PMN count and low protein level in the AF; these cases were considered as CNNA cases. The suggested explanation of failure to detect the causative pathogens in these cases was that, perhaps, they represent the resolution phase of the SBP. Hence, the host defense has eliminated the microorganisms without the use of antibiotics.

Another explanation provided by Hay *et al.*(1996)[46] and Kim *et al.*(2010)[47] was that these CNNA probably represent cases of SBP, but the causative microorganisms were not isolated due to their fastidious nature leading to difficulty in their recovery and identification.

In the present study, the sensitivity of direct Gram-stain of AF in diagnosis of SBP was very low (7.1%), only 5 out of 70 cases were detected by direct Gram-stain. This result was similar to that reported by Renshaw and Doolittle (1997)[48] who found that Gram-stain had very low sensitivity (8%) in diagnosis of SBP. Gram stain can only detect polymicrobial peritonitis in the presence of high number of microorganisms but it is of little value in diagnosis of SBP.

Like in other studies, this report demonstrates that the most common bacteria involved in SBP were Gram-negative bacteria mainly *E. coli*[49-51]. Gram-negative microorganisms of intestinal origin were among the most frequent cause of infection in LC. This can be related to the enhancement of bacterial translocation (BT), defined as the migration of bacteria or bacterial products from the intestinal lumen to mesenteric lymph nodes or from other extra intestinal organs or sites. Such BT plays a significant role in the bacteriology of SBP. However, other study suggested that culture-positive SBP in patients with cirrhosis is most frequently caused by Gram-positive bacteria [52] which were the causative of SBP in 59% of cases. In our study, the proportion of patients with SBP caused by Gram-positive bacteria was only 15 out 58 (25.86%); a finding that was less than that reported by Castellote *et al.*(1990)[43]. In another study, Evans *et al.*(2003)[53] suggested that community-acquired SBP occurring in patients with less advanced liver disease was frequently associated with Gram-positive bacteria.

Wide scale antimicrobial (25 types) agents were used against the isolated microorganisms, and it has been found that Cefotaxime was the most extensively investigated antimicrobial agent in patients with SBP. In our study, it was found to be effective against almost all of the isolates except *E. faecalis*. The resistance of the isolated Gram-negative bacilli and of most of Gram-positive cocci to Cefotaxime was null, yet, other published data indicated that the prevalence of Gram-negative bacilli resistant to Cefotaxime was 7%-28%[52]. Our results indicated that Gram-negative bacilli and almost of Gram-positive cocci were sensitive to Cefotaxime more than other antimicrobial agents. However, *E.*

faecalis showed high sensitivity to meropenem. Furthermore, Cefotaxime can be used as the most effective antimicrobial agent in achieving resolution of SBP. High efficacy of Cefotaxime in SBP can be maintained with short course (5 days) and with high concentration in AF. Moreover, nephrotoxicity and superinfection are less frequent with Cefotaxime treatment[54].

In conclusion, SBP is a serious complication of LC with ascites and it leads to changes in many laboratory parameters. Its occurrence was more in old males; moreover it presents with fever, abdominal pain and tenderness or can be asymptomatic in a substantial number of patients. Using of BCBM was found to be a more sensitive method in the diagnosis of SBP, and by which, a wide range of Gram-negative bacilli (which where the most common) in addition to Gram-positive cocci can be detected in AF of SBP. CNNA is a variant of SBP, wherein the causative microorganisms cannot be isolated from the AF. Therefore, the PMN count of more than 250 cells/mm^3 associated with clinical manifestation is considered a diagnostic. Furthermore, most of the isolated microorganisms were found to be sensitive to Cefotaxime except *E. faecalis*, which showed various degree of sensitivity to ampicillin, piperacillin and meropenem.

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الالتهاب البريتوني التلقائي البكتيري في مرضى التليف الكبدي في المصريين والسعوديين

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المستخلص. هدف هذا البحث التعرف على أهم أنواع البكتيريا المسببة للالتهاب البريتوني التلقائي البكتيري، وحساسيتها للمضادات الحيوية المختلفة، ومعرفة التغيرات المخبرية لسائل الاستسقاء في المرضى. أجرى هذا البحث على ٧٠ مريض مصابين بالالتهاب البريتوني التلقائي البكتيري و ٣٠ مريض بتليف الكبد فقط من المصريين والسعوديين وبعد أخذ التاريخ المرضي لهم تم فحصهم سريريًا ومخبريًا، حيث اشتملت الفحوصات المخبرية على الاختبارات الروتينية والكشف على دلالات الفيروسات الكبدية ب و ج. وأخذت عينات من سائل الاستسقاء لفحصها كيميائيًا وخلويًا وبكتريولوجيًا. لوحظ زيادة معدل الإصابة بمرض الالتهاب البريتوني التلقائي البكتيري في الذكور مع تقدم العمر مصحوبًا بارتفاع درجة الحرارة وآلام بالبطن، ولا يوجد فرق خاص بالجنسية، كما لوحظ زيادة في عدد المرضى المصابين بالصفراء في هذه المجموعة مقارنة بمرض التليف الكبدي فقط، وكذلك في نشاط إنزيمات الكبد، بينما وجد انخفاض في نسبة البروتين والبروثرومبين لديهم، وبتحليل سائل الاستسقاء لوحظ زيادة في عدد الخلايا البيضاء متعددة النواة

وانخفاض في مستوى البروتين والألبيومين والجلوكوز مقارنة بمرضى التليف الكبدي، وقد ثبت أن زراعة سائل الاستسقاء بطريقة مزارع الدم القارورية تفوق الزراعة التقليدية المباشرة على المستنبتات. وقد تم عزل البكتيريا المسببة للمرض والتعرف عليها بالطرق القياسية حيث سادت العصويات المعوية سالبة الجرام على الكرويات موجبة الجرام وأبدت معظم البكتيريا المعزولة حساسية تجاه السايفوتاكسيم ماعدا الكرويات المعوية البرازية التي أبدت حساسية للميروبينيم.