IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 18, Issue 1 Ver. 5 (January. 2019), PP 63-71
www.iosrjournals.org

The prevalence and clinico-microbiological profile of spontaneous bacterial peritonitis in chronic liver disease

Levica Kahit[1], N Biplab Singh[2], Ksh Birendra Singh[2], Kh Sulochana Devi[3]
Wungreipam Kasar[4]
[1]*Post Graduate Trainee, Department of Medicine*
[2]*Professor, Department of Medicine*
[3]*Professor, Department of Microbiology*
[4]*Senior Resident, Department of Medicine*
Regional Institute of Medical Sciences, Imphal, India
Corresponding Author: Dr. N Biplab Singh

Abstract: *Ascites is the most common complication of cirrhosis. Ascitic fluid can become infected without any apparent intra-abdominal source of infection, a condition called Spontaneous bacterial peritonitis. A hospital based cross-sectional study was conducted in 200 patients of chronic liver disease with ascites admitted in the Department of Medicine, RIMS, Imphal between September 2016 and August 2018, to find the prevalence and clinico-microbiological profile of spontaneous bacterial peritonitis. All patients underwent diagnostic paracentesis after giving consent. 42 out of 200 patients, i.e. 21% were found to have SBP, out of which 2 (5%) were female and 40 (95%) were male. 35 (83.33%) patients had Culture Negative Neutrocytic ascites (CNNA), 6 (14.28%) had Classical SBP and 1 (2.38%) had Bacterascites. Most of them were gram negative, mainly Escherichia coli n=5 (71.42%), Klebsiella pnuemoniae n=1 (14.28%) and Staphyloccus aureus n=1 (14.28%). Most organisms isolated were susceptible to ceftriaxone. The most common presenting feature in SBP patients was fever (88.09%), abdominal pain (85.71%), jaundice (71.42%), hepatic encephalopathy (69.04%) and UGI bleed (28.57%). Therefore, the prevalence of Spontaneous bacterial peritonitis is 21% with Escherichia coli being the commonest organism in this setting. History of alcohol consumption, abdominal pain, fever, low ascitic fluid total protein, high indirect bilirubin and low serum protein were found to be predictors of spontaneous bacterial peritonitis.*

Keywords: *Ascites, Cirrhosis, Escherichia coli, Paracentesis, Spontaneous bacterial peritonitis*

Date of Submission: 26-12-2018 Date of acceptance: 11-01-2019

I. Introduction

Ascites is the most common complication of cirrhosis, and 60% of patients with compensated cirrhosis develop ascites within 10 years during the course of their disease.[1] The development of ascites in cirrhosis indicates a poor prognosis. The mortality is approximately 40% at 1 year and 50% at 2 years.[2] Patients with cirrhosis and ascites are at high risk for other complications of liver disease, including refractory ascites, spontaneous bacterial peritonitis (SBP), hyponatremia, or hepatorenal syndrome (HRS). The absence of these ascites related complications qualifies ascites as uncomplicated.[3] Ascitic fluid can become infected without any apparent intra-abdominal source of infection, a condition called Spontaneous bacterial peritonitis.[4] All patients with cirrhosis and ascites are at risk of SBP and the prevalence of SBP in outpatient is 1.5-3.5% and about 10%-30% in hospitalized patients.[5,6] It is generally accepted that it involves three major steps: passage of bacteria from the intestinal lumen, or from other sources in a lower proportion of cases to the systemic circulation; bacteremia secondary to the impairment of the reticuloendothelial system (RES) phagocytic activity, and infection of ascites due to defective bactericidal activity of ascitic fluid.[7]

Patients with SBP may have one of the following: (1) local symptoms and/or signs of peritonitis: abdominal pain, abdominal tenderness, vomiting, diarrhea, ileus; (2) signs of systemic inflammation: hyper or hypothermia, chills, altered white blood cell count, tachycardia, and/or tachypnea; (3) worsening of liver function; (4) hepatic encephalopathy; (5) shock; (6) renal failure; and (7) gastrointestinal bleeding. However, it is important to point out that SBP may be asymptomatic, particularly in outpatients.[8,9]

The diagnosis of SBP is based on diagnostic paracentesis.[10] Currently, spontaneous bacterial peritonitis is diagnosed when:
(a) The ascitic fluid culture grows pathogenic bacteria (almost always pure growth of a single type of organism),
(b) The ascitic fluid polymorphonuclear (PMN) cell count >= 250 cells /mm^3 and
(c) There is no evidence of surgically treatable intra-abdominal sources of infection.[11]

Depending on the cell count and culture of ascitic fluid, it has been classified into its variants.[12,13]
1. Classical spontaneous bacterial peritonitis is defined as ascitic fluid polymorphonuclear count $\geq 250/mm^3$ and positive ascitic fluid culture.
2. Culture negative neutrocytic ascites (CNNA) is defined as ascitic fluid total leukocyte count $\geq 500/mm^3$ or neutrophil count $\geq 250/mm^3$ with negative ascitic fluid culture.
3. Bacterascites (BA) is defined as ascitic fluid neutrophil count $\leq 250/mm^3$ with positive ascitic fluid culture.

More than 90% of all SBP cases are monomicrobial, with aerobic gram negative bacilli being responsible for more than two thirds of all cases. Escherichia coli accounts for nearly half of these cases, followed by Klebsiella species and other gram-negative bacteria. Almost 25% of cases are caused by gram-positive organisms, with streptococcal species being most common.[14-16]

II. Materials And Methods

A Hospital based cross-sectional study was carried out in the Department of Medicine, Regional Institute of Medical Sciences (RIMS), Imphal for a period of 2(two) years from September, 2016 to August, 2018 on 200 patients of chronic liver disease with ascites after obtaining their written informed consent. Approval was taken from the Research Ethics Board, Regional Institute Of Medical Sciences,Imphal.

INCLUSION CRITERIA:
1. 18 years and above
2. Both sexes
3. Diagnosed cases of chronic liver disease with ascites
4. Those who have consented for the study.

EXCLUSION CRITERIA:
1. Age < 18 years
2. Patient who have received antibiotics within 3 weeks prior to admission
3. Ascites due to renal, cardiac, tubercular and malignant pathology
4. Pregnancy
5. Undergone abdominal surgery within 3 months of study entry
6. History of paracentesis in the last two weeks
7. HIV infected patients

After comprehensive history taking and physical examination, patients fulfilling the inclusion criteria were further investigated. Blood samples were collected for Complete haemogram (Haemoglobin, platelet count, total leucocyte count), Liver Function Test (LFT) including bilirubin, albumin, ALT, AST, Kidney Function tests (KFT) including urea, creatinine, sodium and potassium, Prothrombin time (PT/INR) and serological markers (Hepatitis B, C and HIV). Diagnostic paracentesis was done within 24hrs of admission or before starting any antibiotic. With all aseptic precautions by inserting a 22- or 18-gauge needle in the left iliac fossa or midline just below the umbilicus, abdominal paracentesis was performed and samples referred to the laboratory. 10ml of the ascitic fluid was collected into plain sterile containers for total leukocyte count, differential leukocyte count and biochemical analysis. 10 mL was inoculated into blood culture bottle (BacT/ALERTR FA). The usual biochemical, microbiologic and cytologic analytical methods was used to determine total protein, glucose, and total leukocyte and neutrophil counts per mm^3.

Cases with ascites were labeled as having SBP if the ascitic fluid analysis showed either or both of the following:
1. Total polymorphonuclear count >250 cells/mm^3
2. Ascitic fluid culture positive without surgical cause of infection.

Diagnosed cases of SBP were further classified using standard criteria, i.e those with absolute neutrophil count >250 cells/mm^3 (neutrocytic ascites) in the absence of an intra-abdominal source of infection and cultures positive were classified as Classical SBP. For negative ascitic fluid culture in the presence of neutrocytic ascites, were characterized as having culture-negative neutrocytic ascites (CNNA). Patients with positive ascitic fluid cultures but without neutrocytic ascites were classified as having Bacterascites. Several prospective studies have documented the superiority of the use of blood culture bottles as medium for the ascitic fluid. Moreover, the inoculation of ascitic fluid at bedside is superior to delayed inoculation in the laboratory. Each patient were further categorised according to Child-Pugh score(Table 1) for grading the severity of chronic

liver disease. The Child-Pugh score is calculated by assigning 1 point for any feature in column 1, 2 points for any feature in column 2, and 3 points for any feature in column 3; class A ≤6; class B 7-9;and class C ≥10.

Statistical analysis was performed by using IBM: SPSS Statistics Version 21 and MINITAB Release 11.12, 32 Bit. Numerical/continuous variables that follow normality and equality of variances are presented as Mean ± SD (standard deviation) and qualitative/categorical variables are again described as number of cases and percentages. The variation of means of the numerical parameters, considered in the present study, between SBP and Non SBP is tested by Independent Samples t-test and association of qualitative parameters with SBP and Non SBP is tested by chi square test. All comparisons are two-sided and the P-values of < 0.05, < 0.01 and < 0.001 are taken as the cut off values for significance, highly significance and very highly significance respectively. Pie, multiple bar diagrams and divided bar diagrams are used to highlight more clarity of the findings that are shown just below the respective tables.

III. Results

Out of 200 patients, 96% were male and 4% female (Figure 1). 42 (21%) were diagnosed as SBP (Figure 2) out of which 95% were male and 5% were female. The mean age for presentation was 49.93 ± 10.71yrs, with not much difference between SBP and Non SBP. Alcohol (79%) was found to be the most common cause of cirrhosis in this population followed by hepatitis C (14%) with a significant P value of 0.051(Figure 3). Figure 4 shows the most common presenting features in SBP such as abdominal pain (80.5%), fever (80%), jaundice (68.5%), hepatic encephalopathy (67%) and UGI bleed (41.5%). Most common clinical findings were spider naevi (78.57%) with a significant P value of 0.022, icterus (71.42%), leuconychia (69.04%), flaps (69.04%), pedal oedema (66.66%) with a significant P value of 0.005, parotid gland enlargement (45.23%), loss of pubic/ axillary hair (38.09%) and gynaecomastia (21.42%) as shown in Figure 5. Ascites, splenomegaly and tenderness showed a significant P value of 0.008, 0.025 and 0.021 respectively which are features suggestive of portal hypertension. However in this study the most common finding in SBP patients were abdominal tenderness (71.42%), splenomegaly (71.42%), dilated veins (71.42%), massive ascites (52.38%), moderate ascites (47.6%) and hepatomegaly (42.85%). The total protein, albumin and SAAG in ascitic fluid of SBP and NON SBP(Table 2), showed a significant P value of 0.016 and 0.012 for total protein and albumin respectively. The total cell count in the ascitic fluid of patients with SBP and Non SBP varied significantly (P = < .001) and was higher in SBP (i.e. >500), while the pattern of differential cell count in the ascitic fluid of patients with SBP consisted of PMN (80.81%) and lymphocytes (19.42%) which is found to be very significant (P <0.001) and diagnostic of SBP. Gram negative bacilli (72%) and 14% each of gram negative cocci and gram positive cocci were found during ascitic fluid analysis.

In our study, out of 42 cases of SBP, organisms were isolated in 7 cases (35%). Most of them were gram negative, mainly Escherichia coli n=5 (71.42%), Klebsiella pneumoniae n=1 (14.28%) and Staphylococcus n=1 (14.28%). We have found cultures positive only in 7 (17%) cases of which 6 (14.2%) are classical SBP while 1 (2.38%) is bacterascites. 68% of SBP patients are in Child Pugh class C while 32% in class B (P=0.592). Mean of MELD and 30 days mortality score is 23.03±8.21 and 21.61±18.38 with a significant P value of 0.031 which showed the association of SBP with decompensated cirrhosis. Therefore parameters like total protein, albumin, total cell count, PMN%, and culture of the ascitic fluid in a suspected case of SBP were found to be significant whose application will help in early diagnosis and prompt treatment for reducing the mortality rate.

IV. Figures And Tables

Table 1: Child Pugh Score

Variable	Score		
	1 point	2 points	3 points
Encephalopathy	Absent	Mild to moderate	Severe to coma
Ascites	Absent	Slight to Moderate	Tense
Bilirubin (mg/dl)*	<2	2-3	>3
Albumin (g/L)	>3.2	2.8-3.5	<2.8
Prothrombin Time (sec above normal)	<4	4-6	>6

Figure 1: Study population according to gender

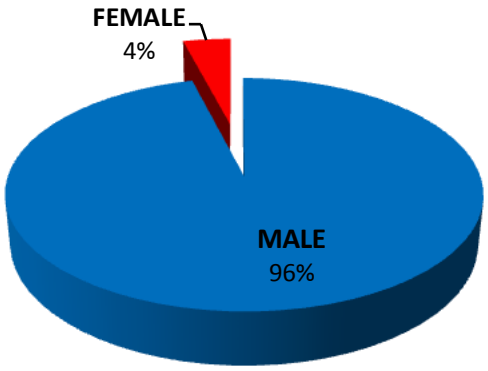


Figure 2: Prevalence of SBP

Figure 3: Etiology of cirrhosis

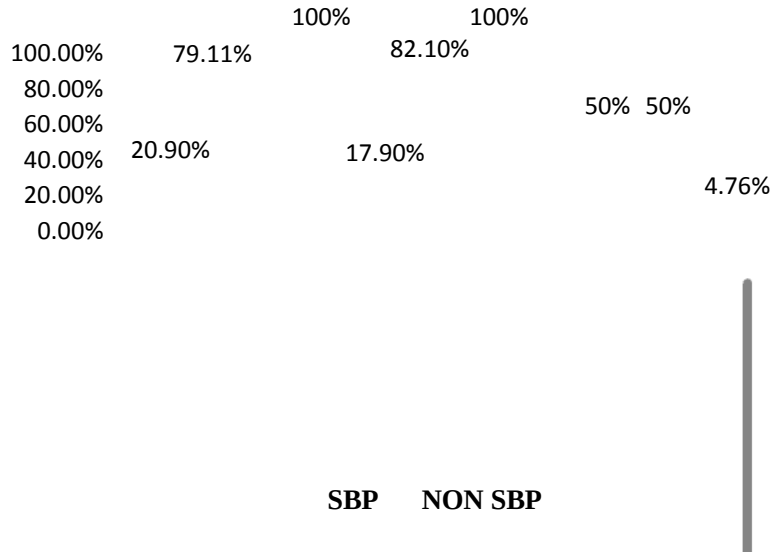


Figure 4: Clinical presentation of SBP patients

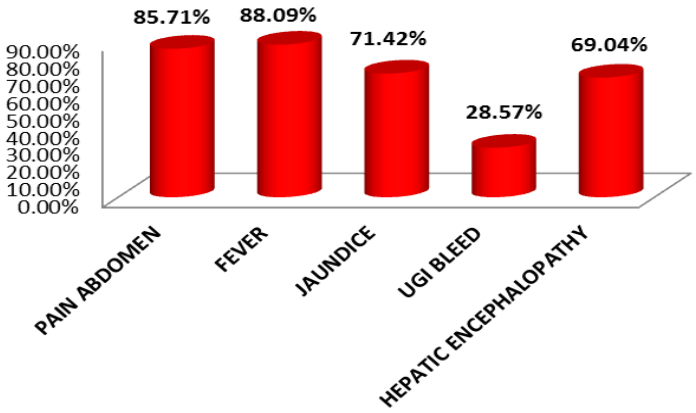


Figure 5: Clinical features of SBP and NON SBP

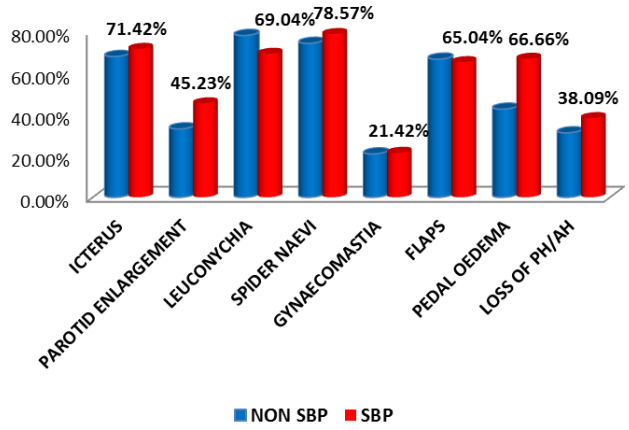


Figure 6: Per abdominal findings in SBP and NON SBP

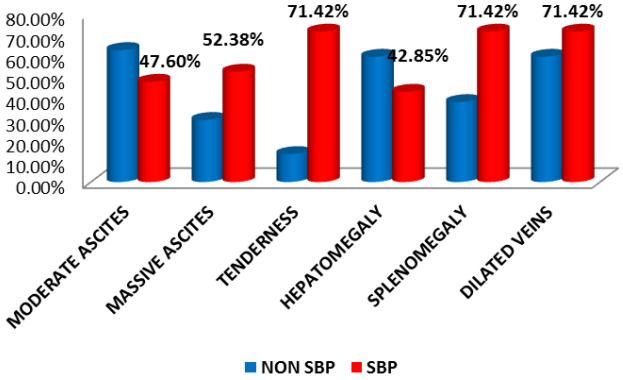


Table 2: Ascitic fluid findings in SBP and Non SBP

Parameters	SBP (42)	Non SBP (158)	Total	t-value	Df	P-value
Protein	1.25±.56	1.50±.71	1.30±.60	2.438	198	0.016
Albumin	.56±.26	.69±.33	.59±.28	2.541	198	0.012
SAAG	1.82±.34	1.73±.32	1.80±.34	1.610	198	0.109
Total count	1139.52± 1098.98	103.89± 66.69	321.37± 656.63	11.845	198	<0.001
Pmn %	80.81± 13.40	15.41± 16.11	29.14± 30.90	24.157	198	<0.001
Lymph %	19.42± 13.43	84.60± 16.12	70.91± 30.82	24.060	198	<0.001

Figure 8: Isolated organisms in SBP patients

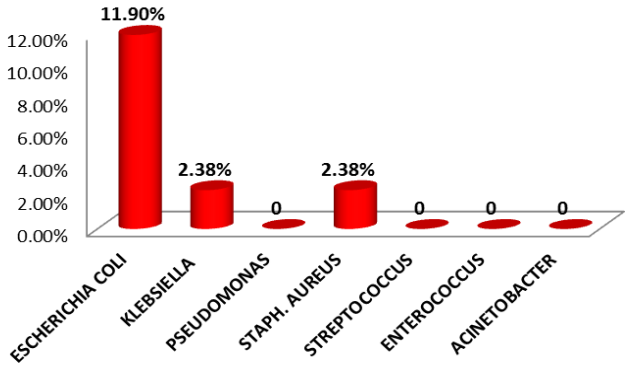
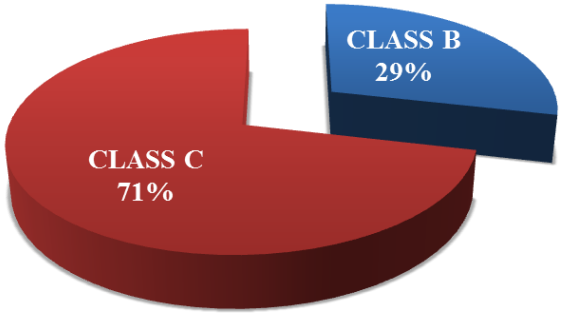


Table 3: Variants of SBP

VARIANTS OF SBP	NO. OF PATIENTS	%
CULTURE NEGATIVE NEUTROCYTIC ASCITES(CNNA)	35	83.33%
CLASSIC SBP (CULTURE POSITIVE)	6	14.2%
BACTERASCITES(BA)	1	2.38%
TOTAL	42	100%

Figure 9: Child pugh score in SBP patients



V. Discussion

All cirrhotic patients with ascites can develop SBP. The prevalence of SBP in hospitalized patients range between 10%-30%.[10] With the early diagnosis of the disease, prompt and appropriate antibiotic treatment, the in-patient mortality of an episode of SBP has been reduced to approximately 20%.[17] The study was carried out in the Department of Medicine, Regional Institute of Medical Sciences, Imphal from September, 2016 to August, 2018. The study included a total of 200 patients of chronic liver disease with ascites out of which 96% were male and 4% were female. All patients underwent diagnostic paracentesis after giving consent. 42(21%) out of 200 patients were found to have SBP, out of which 2 (5%) were female and 40 (95%) were male. A study by Amarapurkar DN et al,[18] reported similar prevalence of 22% in hospitalized patients. We found the mean age of presentation as 49.93± 10.71yrs (P= 0.230) which is similar to a study by Dinis-Ribeiro M et al.[19] In relation to the aetiology, the most common cause of cirrhosis in this study population was alcohol (79%) and hepatitis C (14.5%) with a P value of 0.675. Alcohol intake has been implicated as a cause of alcoholic hepatitis and alcoholic liver cirrhosis and finally causing portal hypertension and ascites.[20] This pattern was similar to that observed in other reports,[21,22] and probably reflects the classical natural history of patients with liver diseases who seek emergency care centers due to development of ascites. Most of these patients have cirrhosis with portal hypertension as a complication of alcoholism or chronic hepatitis C virus infection, and both of these conditions are more prevalent among men.[21,22]

The most common presenting feature among SBP patients was fever (88.09%), abdominal pain (85.71%), jaundice (71.42%), hepatic encephalopathy (69.04%) and UGI bleed (28.57%). Minhas AA et al,[23] reported fever in 54%, pain abdomen in 57% and Hepatic encephalopathy in 67%. In other study, Pelletier G et al[24], found 89% of patients were having fever, UGI bleed (42%), pain abdomen 53% and hepatic encephalopathy in 50% of cases. Twenty nine (69.04%) out of 42 SBP patients were having hepatic encephalopathy of grade 2 (69%), grade 3 (21%) and grade 4 (10%). In this study population, most common clinical findings were spider naevi (78.57%), icterus (71.42%), leuconychia (69.04%), flaps (69.04%), pedal oedema (66.66%), parotid gland enlargement (45.23%), loss of pubic/axillary hair (38.09%) and gynaecomastia (21.42%). Tenderness which is one of the signs of SBP was found in 71.42%. Splenomegaly and dilated veins on the abdominal wall were found in 71.42% which are amongst the hallmark signs of portal hypertension with a significant P value of 0.025 and 0.021 respectively. The mean value of haemoglobin is 8.83± 2.45 gm/dl which could be due to the associated UGI bleed. Most of the patients had features of liver dysfunction at admission as shown by the means of total bilirubin, and prothrombin time of 8.46±7.29 mg/dl, 2.40±.42 and 20.02±5.67 sec respectively. Similar trend was noted in a study by Thanopoulou AC et al.[25]

The gold standard for diagnosis of SBP is ascitic fluid culture, but in the present study other methods like polymorphonuclear leucocytes count[26] were also used. Ascitic fluid cell count has been used in several studies to diagnose SBP and the PMNs ≥250 cell/µL is diagnostic.[27] From the ascitic fluid analysis, total protein and albumin were significant findings (P= 0.016 and P= 0.012 respectively). Verma R et al[28] also reported Mean±SD of SAAG for SBP and Non SBP was (1.94±0.36) and (2.09±0.47 g/dl) respectively which is a similar finding in our study i.e. 1.82±.34 and 1.73±.32 respectively. The total cell count in the ascitic fluid of patients with SBP and NON SBP varied significantly (P = < 0.001) with a mean of 1139.52±1098.98 and 103.89± 66.69 respectively which is similar to the study done by Tariq Mehr M et al[29] and higher in SBP (i.e >500), while the pattern of differential cell count in the ascitic fluid of patients with SBP consisted of PMN (80.81%) and lymphocytes (19.42%) which is found to be very significant (P <0.001). The most common

finding on gram staining of the ascitic fluid is the prevalence of gram negative bacilli (83%) and 17% of gram positive cocci.

Of the 200 patients studied, 42 were diagnosed as having SBP or its variants of whom 35 (83.33%) patients had Culture Negative Neutrocytic ascites (CNNA), 6 (14.28%) had Classical SBP and 1 (2.38%) had Bacterascites. Most of them were gram negative, mainly Escherichia coli n=5 (71.42%), Klebsiella pnuemoniae n=1 (14.28%) and Staphyloccus aureus n=1 (14.28%) which was a similar finding in[26] other studies. E.coli was found as most common organism in most of the other studies ranging approximately 60% of all positive culture which was also observed in our study. Paul K et al[31] also reported a similar observation on E.coli, as the predominant isolate. Ajayi AO et al[32] also reported a similar observation of E.coli isolation in 70% of the SBP cases. The isolation of E.coli, Staphylococcus aureus is consistent with the study done in Kathmandu in Nepal and Kenyatta Hospital in Kenya.[33,34] Jain AP et al,[35] found Staphylococcus as the most common organism. This low proportion of positive ascitic fluid is probably due to the relatively low concentration of bacteria in ascitic fluid. The low rate of culture positivity can be attributed to prior antibiotic intake by the patients. Runyon BA et al,[14] in spite of using sensitive methods of cultures, culture of ascitic fluid was negative in 40% of the cases with typical clinical feature of SBP and elevated ascitic PMN. The prevalence of SBP depends on severity of liver dysfunction, being higher in advanced liver disease. Puri AS et al,[13] reported 21 out of 70 i.e. 30% had SBP or its variants and 77% of their patients were in class C. In our study, 68% of patients were Child Pugh class C.

Therefore in our study we have found the correlation between the aetiology and severity of liver dysfunction and the predisposing factors of SBP. From amongst the clinical parameters, the significant findings were for UGI bleed (0.056), moderate to massive ascites (0.008), splenomegaly (0.025), dilated veins on abdominal wall (0.021) and urea (0.001), MELD score (0.064) and 30 days mortality (0.031) which showed the severity of the disease. From the biochemical and microbiological parameters we have found significant differences between SBP and NON SBP, in ascitic fluid analysis i.e total leucocyte count (<0.001), pmn% (<0.001) and lymph% (<0.001), total protein (0.016) and albumin (0.012) which are diagnostic findings of SBP, and the presence of which confirms the clinical suspicion of SBP in a patient for prompt management to reduce mortality.

VI. Conclusion

In the present study on chronic liver disease with ascites, the prevalence of spontaneous bacterial peritonitis is 21% with alcohol being the most common etiological factor in 79% of the patients followed by hepatitis C. The most common presenting features are fever, abdominal pain, jaundice, hepatic encephalopathy and UGI bleed. Most episodes of SBP were caused by gram-negative bacteria with Escherichia coli being the most common organism isolated in 71.42% of positive ascitic fluid cultures. Therefore, all cases of liver cirrhosis with ascites should undergo diagnostic abdominal paracentesis during admission because these symptoms are highly suggestive of SBP.

References

[1]. Gines P, Quintero E, Arroyo V, Teres J, Bruguera M, Rimola A et al. Compensated cirrhosis: natural history and prognostic factors. Hepatology 1987;7:122-8.
[2]. Guevara M, Cardenas A, Uriz J, Gines P. Prognosis in patients with cirrhosis and ascites. In: Gines P, Arroyo V, Rodes J, Schrier RW, editors. Ascites and renal dysfunction in liver disease: pathogenesis, diagnosis and treatment. 2nd Edn. Malden: Blackwell; 2005. p. 260-70.
[3]. Moore KP, Wong F, Gines P, Bernardi M, Ochs A, Arroyo V et al. The management of ascites in cirrhosis: report on the consensus conference of the International Ascites Club. Hepatology 2003 Jul;38(1):258-66.
[4]. Parsi MA, Saadeh S, Zein N, Davis G, Lopez R, Boone J et al. Ascitic Fluid Lactoferrin for Diagnosis of Spontaneous Bacterial Peritonitis. Gastroenterology 2008 Sep;135(3):803-7.
[5]. Rimola A, Soto R, Bory F, Arroyo V, Piera C, Rodes J. Reticuloendothelial system phagocytic activity in cirrhosis and its relation to bacterial infections and prognosis. Hepatology 1984 Jan;4(1):53-8.
[6]. Fernandez J, Navasa M, Gomez J et al. Bacterial infections in cirrhosis: epidemiological changes with invasive procedures and norfloxacin prophylaxis. Hepatology 2000 Jan;35(1):140-8.
[7]. Silvian C, Besson I, Ingrand P et al. Prognosis and long term recurrence of spontaneous bacterial peritonitis in cirrhosis. J Heptol 1993;19(1):188-9.
[8]. Lata J, Stiburek O, Kopacova M. Spontaneous bacterial peritonitis: A severe complication of liver cirrhosis. J. Gastroenterol 2009;15(44):5505–10.
[9]. Nousbaum JB, Cadranel JF, Nahon P, Nguyen Khac E, Moreau R, Thevenot T et al. Diagnostic accuracy of the Multistix 8 SG reagent strip in diagnosis of spontaneous bacterial peritonitis. Hepatology 2007 May;45(5):1275–81.
[10]. Evans LT, Kim WR, Poterucha JJ, Kamath PS. Spontaneous bacterial peritonitis in asymptomatic outpatients with cirrhotic ascites. Hepatology 2003 Apr;37(4):897–901.
[11]. Rimola A, Gracia-Tsao G, Navasa M, Piddock LJ, Planas R, Bernard B et al. Diagnosis, treatment and prophylaxis of spontaneous bacterial peritonitis: a consensus document. International Ascites Club. J Hepatol 2000 Jan;32(1):142-53.
[12]. Amri SM, Allam AR, Mofleh IA. Spontaneous bacterial peritonitis and culture negative neutrocytic ascites in patients with non-alcoholic liver cirrhosis. J Gastroenterol Hepatol 1994 Sep;9(5):433-6.

[13]. Puri AS, Puri J, Ghoshel UC, Sharma BC, Sarawat VA, Ayyagari A et al. Frequency, microbial spectrum and outcome of SBP in north India. Indian J Gastroenterol 1996 Jul;15(3):86–9.
[14]. Runyon BA, Canawati HN, Akriviadis EA. Optimization of ascitic fluid culture technique. Gastroenterology 1988 Nov;95(5):1351-5.
[15]. Castellote J, Xiol X, Verdaguer R, Rides J, Guardiola J, Gimenez A et al. Comparison of two ascitic fluid culture methods in cirrhotic patients with spontaneous bacterial peritonitis. Am J Gastroenterol 1990 Dec;85(12):1605-8.
[16]. Bodadilla M, Sifuentes J, Garcia TG. Improved method for bacteriological diagnosis of spontaneous bacterial peritonitis. J Clin Microbiol 1989 Oct;27(10):2145-7.
[17]. Sipeki N, Antal-Szalmas P, Lakatos PL, Papp M. Immune dysfunction in cirrhosis. World J Gastroenterol 2014 Mar;20(10):2564-77.
[18]. Amarapurkar DN, Viswanathan N, Parikh SS, Kalro RH, Desai HG. Prevalence of Spontaneous Bacterial Peritonitis. J Assoc Physician India 1992 Apr;40(4):236-8.
[19]. Dinis-Ribeiro M, Cortez-Pintoh H, Marinho R, Valente A, Raimundo M, Salgado MJ et al. Spontaneous Bacterial Peritonitis in patients with hepatic cirrhosis: evaluation of a treatment protocol at specialized units. Rev Esp Enferm Dig 2002 Aug;94(8):473-81.
[20]. Alvarez MA, Cirera I, Solà R, Bargalló A, Morillas RM, Planas R. Long-term clinical course of decompensated alcoholic cirrhosis: a prospective study of 165 patients. J. Clin. Gastroenterol 2011 Nov;45(10):906-11.
[21]. Garcia-Tsao G, Lim JK, Lim J. Management and treatment of patients with cirrhosis and portal hypertension: recommendations from the Department of Veterans Affairs Hepatitis C Resource Center Program and the National Hepatitis C Program. Am. J. Gastroenterol 2009 Jul;104(7):1802–29.
[22]. Koulaouzidis A, Bhat S, Karagiannidis A, Tan WC, Linaker BD. Spontaneous bacterial peritonitis. Postgrad. Med. J 2007 Jun;83(980):379-83.
[23]. Mihas AA, Toussaint J, Hsu HS, Dotherow P, Achord JL.Spontaneous bacterial peritonitis in cirrhosis: clinical and laboratory features, survival and prognostic indicators. Hepatogastroenterology 1992 Dec;39(6):520-2.
[24]. Pelletier G, Lesur G, Ink O, Hagege H, Attali P, Buffet C et al. Asymptomatic bacterascites: is it spontaneous bacterial peritonitis? Hepatology 1991 Jul;14(1):112-5.
[25]. Thanopoulou AC, Koskinas JS, Hadziyannis SJ. Spontaneous bacterial peritonitis (SBP): clinical, laboratory, and prognostic features: A single-center experience. Eur J Intern Med 2002 May;13(3):194-8.
[26]. Runyon BA, Hoefs JC. Culture-negative neutrocytic ascites: a variant of spontaneous bacterial peritonitis. Hepatology 1984 Nov;4(6):1209-11.
[27]. Agarwal MP, Choudhury BR, Banerjee BD, Kumar A. Ascitic Fluid Examination for Diagnosis of Spontaneous Bacterial Peritonitis in Cirrhotic Ascites. J Indian Acad. Clin. Med. 2008 Jan;9(1):29-32.
[28]. Verma R, Giri R, Agarwal M, Srivastava V. To study the relation between spontaneous bacterial peritonitis and serum ascites albumin gradient in chronic liver disease patients. International Journal of Research in Medical Sciences 2017;5(8):3654-8.
[29]. Muhammad Tariq Mehr, Humera Khan, Noor ul Iman. Frequency and types of spontaneous bacterial peritonitis in liver cirrhosis: J. Med. Sci 2011 Oct; 19(4):200-3.
[30]. Filik L, Unal S. Clinical and Labaratory features of Spontaneous Bacterial Peritonitis. East Afr Med J 2004 Sep;81(9):474-9.
[31]. Paul K, Kaur J, Kazal HL. To study the Incidence, Predictive Factors and Clinical Outcome of Spontaneous Bacterial Peritonitis in patients of Cirrhosis with Ascites. J Clin Diagn Res 2015 Jul;9(7):OC09-12.
[32]. Ajayi AO, Patrick AT, Ajayi EA, Raimi HT, Dada SA. Prevalence of spontaneous bacterial peritonitis in liver cirrhosis with ascites. Pan African Medical Journal 2013 Aug;15:128.
[33]. Patil N. Study of Spontaneous Bacterial Peritonitis in cirrhosis of liver with ascites with special reference to serial ascitic fluid cell count as prognostic marker. J Assoc physicians India 2008;18:23-6.
[34]. Lule GN. Prevalence of Spontaneous Bacterial Peritonitis at Kenyatta hospital. East Afr. Med. J 2005 Apr;82(4):166-9.
[35]. Jain AP, Chandra LS, Gupta S, Gupta OP, Jajoo UN, Kalantri SP. Spontaneous Bacterial Peritonitis in liver cirrhosis with ascites. J Assoc physicians India 1999 Jun;47(6):619-21.