

## Bugs Commonly Causing Spontaneous Bacterial Peritonitis in Patients With Decompensated Liver Disease

MUHAMMAD AMJAD, MUHAMMAD ASIF GUL, SHAFQAT RASOOL, AKIF DILSHAD, ALI HYDER, NOUMAN HAMEED

Department of Medicine, Lahore General Hospital, Lahore.

Correspondence to Dr. Muhammad Asif Gul, Email: asifgul141@gmail.com, Cell: 03219466846

### ABSTRACT

**Aim:** To determine the type of infection causing organism among those patients who have spontaneous bacterial peritonitis along with liver cirrhosis. So this study was designed and executed.

**Methodology:** Patients who have liver cirrhosis and bacterial peritonitis were the target population. A sample of 150 cases was recruited after their informed consent. Patients were later subjected ascitic fluid paracentesis and then to reagent strip for leukocyte esterase detection (e.g. combur10 urine strips). Data was analyzed by SPSS.

**Results:** The participant's mean age was  $37.31 \pm 9.44$ . The male cases were 121(80.7%). 130(86.6%) were those patients who have positive culture for microorganisms. *E. coli* was present in 91(60.7%),

**Conclusion:** The most common organism reason for spontaneous bacterial peritonitis found was *E. coli* followed by *Klebsiella*.

**Keyword:** Liver cirrhosis, Bacterial peritonitis, *E. coli*, *Klebsiella*.

---

### INTRODUCTION

Cirrhosis is a life threatening and irreversible disorder of liver in which it is replaced by fibrous tissue. It results in loss of normal functions of liver. There is long list of causes including viral, toxin mediated, metabolic and idiopathic.<sup>1</sup> Alcoholic and non-alcoholic fatty liver are also important causes of liver disease.

There are many complications of cirrhosis like variceal bleeding, Porto systemic encephalopathy, liver cancer and ascites<sup>1,2</sup>. One of most dreadful complications of decompensated liver disease is ascites. It is accumulation of free fluid in peritoneal cavity and results in significant morbidity and mortality. Ascites may be spontaneously infected due to increased permeability of vessels known as spontaneous bacterial peritonitis (SBP).

As mentioned earlier SBP is frequent and serious complication in patients with liver cirrhosis which carries high mortality<sup>3</sup>. SBP is defined as infection of the ascitic fluid with normal flora of intestine in the absence of an obvious source in abdomen e.g., visceral perforation or abscess. In western countries incidence of SBP in hospitalized patients varies from 7–23%. In contrast it is significantly high in our country approximately 33–39%<sup>5</sup>.

In cirrhosis there is decreased synthesis of albumin which results poor opsonization and increased permeability and ultimately result in bacterial translocation from the intestinal lumen into ascitic fluid. It is very crucial step in pathogenesis of SBP<sup>6</sup>.

Microorganisms causing SBP is mostly gram negative, these bugs when outgrow the capacity of mesenteric lymph nodes tumble into the blood stream. Subsequently these bacteria circulating in blood vessels translocate into ascitic fluid causing spontaneous bacterial peritonitis. Hence mostly organisms are derived from the normally present intestinal commensals. Interestingly a single microorganism is cultured from ascitic fluid. *E. coli* or a *Klebsiella* species are common bugs frequently present in ascitic fluid<sup>7</sup>.

S Zaman et al<sup>8</sup> found that the bacteria causing spontaneous bacterial peritonitis, 39.28% gram negative anaerobic organisms cultured from the ascitic fluid<sup>9</sup>. The most common microorganisms cultured from ascitic fluid in descending order were *Escherichia coli* (70%), *Klebsiella* species (10%), *Proteus* species (4%), *Enterococcus faecalis* (4%), *Pseudomonas* species (2%) and others (6%)<sup>10</sup>. Isolation of gram negative bacteria was 40–50%<sup>11,12</sup> in Western countries. In contrast only *E. Coli* was main culprit causing SBP in 50% of the cases studied in one of institutions in Pakistan.

Hence in our country, most common bug isolated from ascitic fluid was *E. coli* (33.8%), followed by *staphylococcus aureus* (8.9%) and *Enterococcus* (8.6%). There were no substantial changes noted in the percentage of gram-negative/gram-positive infections<sup>13</sup>.

There lies variability in the literature so this study was planned to determine the actual burden of specific type of microorganism.

### MATERIAL AND METHODS

Total participants of this study were hundred and fifty recruited from emergency, outpatient and inpatient medical departments of Lahore General Hospital Lahore. Informed written consent was taken from all the patients. Patients of any gender with age between 18–60 year and confirmed cases of SBP (have positive leukocyte count >250 cells/mm<sup>3</sup>) and liver cirrhosis (on USG of liver) were enrolled in this study. Cases who had abdominal trauma or surgery, tuberculosis, malignancy and on antibiotic before 48 hour of presentation were excluded from this study.

Ascitic fluid analysis was done by performing diagnostic ascitic of all patients. Under aseptic measures 20 ml of ascitic fluid was aspirated in a heparinized disposable syringe. Out of it 10 ml was immediately subjected to Reagent strip test by using of a reagent strip for leukocyte esterase detection (e.g. combur10 urine strips). The other 10 ml ascitic fluid of those patients who have positive reagent test (i.e., SBP) was sent to the laboratory in culture bottle for gram staining and culture. All data was recorded in a predesigned Performa. Data was

---

Received on 24-05-2019

Accepted on 15-10-2019

analyzed using SPSS 20. Respective descriptive statistics was calculated and presented as per type of variables.

## RESULTS

There were total 150 cases that were enrolled in this study. The mean age of the patients was  $37.31 \pm 9.44$ . The male cases were 121(80.7%) and female cases were 29(19.3%). When patients were evaluated for presence of microorganisms there were 130(87%) who have positive culture for microorganisms while 20(13%) were found negative for microorganisms. *E. coli* was present in 91(60.7%) and absent in 59(39.3%), Klebsiella was found in 17(11.3%) and not present in 133(88.7%), *S. Aureus* was found in 11(7.3%) and absent in 139(92.7%), Enterococcus was present in 11(7.3%) and not found in 138(92.7%). Mean duration of disease was  $2.53 \pm 1.14$  years (Graph 1). When data was stratified for duration of disease it was found that there was significant difference with respect to duration of presence of *S. Aurias* in patients

with less than two year and greater than two years of disease ( $p\text{-value}=0.02$ , Table 1).

Graph 1: Distribution of microorganism in the SBP in liver cirrhosis

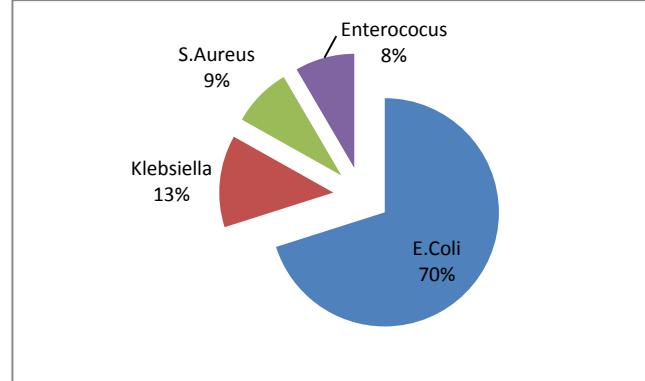


Table 1: Effect of duration of liver cirrhosis on Frequency of micro-organism.

		Duration of disease		P-value
		1-2 years	>2years	
		Yes	No	
Presence of E.Coli	Yes	49(53.8%)	42(46.2%)	0.505
	No	28(47.5%)	31(52.5%)	
Presence of Klebsiella	Yes	9(52.9%)	8(47.1%)	1.000
	No	68(51.1%)	65(48.9%)	
Presence of S. Aurius	Yes	2(18.2%)	9(81.9%)	0.028
	No	75(54%)	64(46%)	
Presence of Enterococcus	Yes	8(72.7%)	3(27.3%)	0.211
	No	69(49.6%)	70(48.7%)	

## DISCUSSION

Spontaneously infected ascitic fluid by normal commensals of intestine in patients with decompensated liver disease is SBP. It is translocation of micro-organism due to increased vascular permeability and in absence of a perforation of any viscera or any intra-abdominal inflammatory process such as appendicitis, pancreatitis and cholecystitis. SBP diagnosis can be made by presence of equal or more than 250 cells/mm<sup>3</sup> polymorph nuclear leucocytes (PMN) plus isolation of single micro-organism from ascitic fluid cultures<sup>14</sup>. Most of the times culture sensitivity of ascitic fluid yielded single bug, if there is growth of more than one organism it will raise suspicion of secondary bacterial peritonitis<sup>15</sup>.

Clinical presentations of SBP are very much diverse ranging from diarrhea to Porto systemic encephalopathy (PSE). The commonly presented complaints were fever (69%), abdominal pain (59%), PSE, ileus, diarrhea, hypothermia and shock. Almost 10% of SBP patients didn't exhibit any symptom. And hence different physical signs are there depending upon presentation. Mostly they don't have abdominal rigidity because peritoneal membranes could not come in contact because large amount of ascitic fluid in between them (visceral and parietal)<sup>16</sup>.

Diagnostic ascitic tap with cellular count and its culture is recommended in all patients with decompensated cirrhosis with ascites. Either patient admitted to hospital with new onset ascites or with worsening of ascites who have presented with fever, abdominal pain, diarrhea,

leukocytosis or altered mentation or deranged renal function tests.

High degree of suspicion followed by immediate laboratory tests will help in early diagnosis and favorable outcome. Deranged renal function with SBP can affects outcome adversely and similarly deranged renal function may be the result of untreated ascitic fluid infection i.e. SBP<sup>17</sup>.

Although there are different variants of SBP however most common is mono bacterial neutrocytic ascites and it is almost present in 50-60% of cases.<sup>18</sup> In vast majority of cases causative organisms are aerobic gram negative bacilli and as mentioned earlier SBP most of the times caused by single organism and accounts for more than 92% of cases. Most common bug is *Escherichia coli* and then *Klebsiella* species are being isolated from ascitic fluid culture.<sup>19</sup> Gram-positive organisms found in approximately 25% cases and were caused commonly by streptococcal species and then next common gram positive organism is *staphylococcus aureus*. Only 1% of monobacterial SBP caused by anaerobe.<sup>20</sup> Interestingly Anaerobes were not isolated from ascitic fluid of patients participating in our study.

As reported by Gills AS et al<sup>21</sup> our study also demonstrated that almost 93% SBP caused by aerobic Gram negative bacilli and was monomicrobial and is was responsible for about 66.7% of our cases. Next to *E. coli* we found *Klebsiella* species to be the commonest bug. Gills et al also found *E.coli* as most common bacteria

causing SBP.<sup>22</sup> Another study conducted in tertiary care hospital Peshawar found causative organism of SBP, E. coli was found in 58.13%, S. pneumoniae in 18.60%, S. aureus in 9.13%, Klebsiella in 9.13% and Acinetobacter in 4.63%. 33.3% of cases caused by gram positive organisms, Streptococcal species predominantly found in 60% while S. aureus found in 40%. Similar results of organisms were also found by Iqbal<sup>22</sup> and also to other studies<sup>23</sup> as frequency of E. Coli in our study were also as compared to other microorganisms.

However there is some difference in frequency of microorganisms in our study as determined by the study by various other researchers. In the study by Sheikh bhabie S<sup>24</sup>, the most common isolated organisms were as follows: E. coli (33.8%), S. aureus (8.9%), Enterococcus (8.6%), Acinetobacter (8%), Candida (7.3%), Staphylococcus epidermidis (6.7%), and Klebsiella (5.4%). Our result indicated that E. coli is still the most common cause of culture-positive neutrocytic SBP. This corresponds to the data obtained in other investigations<sup>25, 26, 27</sup>.

There is also limitation present in this study. Limitation of this study that it was conducted on smaller sample size due to limited resources and time. More studies are needed for further validation of results so that proper plans for management of SBP in liver cirrhosis could be made.

## REFERENCES

1. Tuma P, Medrano J, Resino S, Vispo E, Madejón A, Sánchez-Piedra C, et al. Incidence of liver cirrhosis in HIV infected patients with chronic hepatitis B or C in the era of highly active antiretroviral therapy. *Antivir Ther* 2010;15:881-6.
2. Merino-Rodríguez B, Nunez-Martínez O, Díaz-Sánchez A, Matilla-Peña A, Clemente-Ricote G. Spontaneous bacterial peritonitis in cirrhotic patients over 65 years. *Med Clin (Barc)* 2009;133:167-72.
3. Garcia-Tsao G, Dooley SJ, Lok FSA, Burroughs KA, Heathcote JE. Ascites. In: *Sherlock Diseases of the liver and biliary system*. 12<sup>th</sup> ed. Oxford, England: Blackwell Science; 2011.p. 1227-46.
4. Jamil S, Ahmed S, Memon A, Masood S, Ali Shah SH, Hamid SS, WasimJafri SM. Factors predicting the recurrence of spontaneous bacterial peritonitis in patients with cirrhosis. *J Coll Physicians Surg Pak* 2011;21:407-10.
5. Ajayi AD, Adegun PT, Ajayi EA, Raimi HT, Dada SA. Prevalence of spontaneous bacterial peritonitis in liver cirrhosis with ascites. *Pan African Med J* 2013; 15:128.
6. Zaman A, Kareem R, Mahmood R, Hameed K, Khan EM. Frequency of microbial spectrum of spontaneous bacterial peritonitis in established cirrhosis liver. *J Ayub Med Coll Abbottabad* 2011;23(4):15-7.
7. Wiest R, Lawson M, Geuking M. Pathological bacterial translocation in liver cirrhosis. *J Hepatol* 2014;60:197-209.
8. Zaman A, Kareem R, Mahmood R, Hameed K, Khan ME. frequency of microbial spectrum of spontaneous bacterial peritonitis in established cirrhosis liver. *J Ayub Med Coll Abbottabad* 2011;23:15-7.
9. Cohen MJ, Sahar T, Benenson S, Elinav E, Brezis M, Soares-Weiser K. Antibiotic prophylaxis for spontaneous bacterial peritonitis in cirrhotic patients with ascites, without gastrointestinal bleeding. *Cochrane Database Syst Rev* 2009; (2): CD004791.
10. Arroyo V, Bataller R, Gine's P. Spontaneous Bacterial Peritonitis, eds. O'Grady and Lake's comprehensive clinical hepatology, 1st ed. Barcelona: Mosby, 2000: 7.10-7.14.
11. Franca AV, De Souza JB, Silva CM, Soares EC. Longterm prognosis of cirrhosis after SBP treated with Ceftriaxone. *J ClinGastroenterol* 2001; 33: 295-8.
12. Rajput RM, Zuberi FB, Sheikh MW, Solangi AG, Shaikh MS, Shaikh MG. Frequency, microbial spectrum, clinical and biochemical features of SBP and its variants. *J Coll Physicians Surg Pakistan* 1999; 9: 347-50.
13. Sheikbahaei S, Abdollahi A, Hafezi-Nejad N, Zare E. Patterns of antimicrobial resistance in the causative organisms of spontaneous bacterial peritonitis: A single centre, six-year experience of 1981 samples. *Int J Hepatol* 2014;(2014):6.
14. Moore K. Spontaneous bacterial peritonitis (SBP). In Warrel DA et al. *Oxford Textbook of Medicine*, 4th Edition, Oxford University Press 2003; 2:739-741
15. Levison ME, Bush LM. Peritonitis and intraperitoneal abscesses. In Mandell GL, Bennett JE, Dolin R. *Principles and Practice f Infectious Diseases*. 6th Edition, Elsevier, Churchill Livingstone, Philadelphia, 2005; 1: 927-951
16. Cáruntu FA. Spontaneous Bacterial Peritonitis: Pathogenesis, Diagnosis, Treatment. *Gastrointest Liver Dis* 2006 Vol.15 No.1, 51-56
17. Lata J, Stiburek O, Kopacova M. Spontaneous bacterialperitonitis: A severe complication of liver cirrhosis. *World JGastroenterol* 2009; 15(44): 5505-5510
18. Parsi MA, Atreja A, Nizar NZ. Spontaneous bacterial peritonitis: Recent data on incidence and treatment. *Cleveland Clinic Journal of Medicine*. 2004; 71(7):564-570.
19. Runyon BA. Monomicrobial nonneutrocytic bacterascites: A variant of spontaneous bacterial peritonitis. *Hepatology*. 1990; 12(4 pt. 1):710-715.
20. Garcia-Tsao G. Spontaneous bacterial peritonitis. *Rev Gastroenterol Mex*. 2005;70Suppl 3:66-8.
21. Gills AS, Singh A, Matreja PS, Chinna RS, Mahajan R, Chhina DK. Spontaneous bacterial peritonitis in liver cirrhosis: An Indian perspective. *Euroasian J Hepato-Gastroenterol*. 2012; 2(1): 14-19.
22. Iqbal S, Iman N, Alam N. Incidence of spontaneous bacterial peritonitis in liver cirrhosis, the causative organism and antibiotic sensitivity. *J Postgrad Med Inst*. 2004; 18: 614-619.
23. Oladimeji AA, Temi AP, Adekunle AE, Taiwo RH, &Ayokunle DS. Prevalence of spontaneous bacterial peritonitis in liver cirrhosis with ascites. *Pan African Med J* 2014;15(1).
24. Sheikbahaei S, Abdollahi A, Hafezi-Nejad N, &Zare E. Patterns of antimicrobial resistance in the causative organisms of spontaneous bacterial peritonitis: a single centre, six-year experience of 1981 samples. *Int J hepatol* 2014.
25. M. K. Park, J. H. Lee, Y. H. Byun et al., "Changes in the profiles of causative agents and antibiotic resistance rate for spontaneous bacterial peritonitis: an analysis of cultured microorganisms in recent 12 years," *The Korean J Hepatol* 2007; 13(3):370-377
26. L. Piroth, A. Pechinot, A. Minello et al., "Bacterial epidemiology and antimicrobial resistance in ascitic fluid: a 2-year retrospective study," *Scandinavian J Infect Dis* 2009; 41(12):847-851.
27. G. Bhat, K. E. Vandana, S. Bhatia, D. Suvarna, and C. G. Pai, "Spontaneous ascitic fluid infection in liver cirrhosis: bacteriological profile and response to antibiotic therapy," *Indian J Gastroenterol* 2013;32(5): 297-301,