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Frequency and Outcomes of Spontaneous Bacterial Peritonitis in Patients of Chronic Liver Disease

Iraj Fatima[1], Bikha Ram Devrajani[2], Dolat Singh Sodho[3], Prem Kumar[4], Muhammad Khalid Nizamani[5]

[1]Postgraduate trainee Medicine, Indus Medical College & Hospital TMK
[2]Dean of postgraduate studies, The University Modern Sciences Indus Medical College TMK
[3]Assistant Professor of Medicine, Indus Medical College & Hospital TMK
[4]Professor of gastroenterology, Isra University Hospital Hyderabad
[5]Senior registrar, Internal Medicine, Indus Medical College, TM Khan

Author`s Contribution

[1,3]Substantial contributions to the conception or design of the work; or the acquisition, [2,3]Drafting the work or revising it critically for important intellectual content, [4]Active participation in active methodology, [2]Final Approval, [5]Data Analysis, Literature review

Funding Source: None
Conflict of Interest: None

Received: Apr 26, 2026
Revised: Aug 03, 2026
Accepted: Aug 18, 2026

Address of Correspondent
Dr. Iraj Fatima
Postgraduate trainee Medicine,
Indus Medical College & Hospital TMK
fatimamemonhyd@gmail.com

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ABSTRACT

Objective: To determine the frequency and outcomes of Spontaneous Bacterial Peritonitis (SBP) in patients of Chronic Liver Disease (CLD) with ascites.

Methodology: This Descriptive cross-sectional study was done at Medicine department of Indus Medical College & Hospital Tando Muhammad Khan, Sindh, Pakistan, from August 2025 to January 2026. One hundred and sixty-three diagnosed cases of Chronic Liver Disease were enrolled using convenience sampling technique. All cases were physically examined followed by abdominal paracentesis for obtaining ascitic fluid for culture and sensitivity and total white blood cells (WBCs) count for confirming SBP. Data were entered and analyzed using SPSS version 26.

Results: Among the 180 patients with CLD, 57.2% were male and 42.8% were female, with a mean age of 49.52 ± 6.55 years. In patients with SBP 59 (32.8%), the average white blood cell (WBC) count exceeded 600 cells/mm³ and ascitic fluid cultures were positive in only 18.6% of SBP cases, with Escherichia coli (5.1%) and Klebsiella species (6.8%) being the most frequently isolated pathogens. Of the total study population, 167 (92.8%) improved and were discharged from the hospital, while 13 (7.2%) died during hospitalization. SBP was significantly associated with adverse outcomes (P<0.05).

Conclusion: Spontaneous bacterial peritonitis observed prevalent among hospitalized patients with chronic liver disease, and it is strongly linked to progressive hepatic decompensation, prolonged hospitalization and mortality.

Keywords: SBP, Chronic liver disease, Paracentesis, Ascitic fluid.

Cite this article as: Fatima I, Devrajani BR, Sodho DS, Kumar P, Nizamani MK. Frequency and Outcomes of Spontaneous Bacterial Peritonitis in Patients of Chronic Liver Disease. Ann Pak Inst Med Sci. 2026; 22(4):432-436. doi. 10.48036/apims.v22i4.1748.

Introduction

Chronic liver disease (CLD) is commonly defined as the gradual degradation of liver function. The ongoing process of CLD causes inflammation, liver parenchymal damage, and regeneration, ultimately resulting in cirrhosis and fibrosis.[1,2] Liver cirrhosis, a state in which the liver is severely damaged but may still be able to sustain daily life, is a consequence of several chronic liver diseases.[3] Globally, CLD is one of the leading causes of morbidity and mortality, as well as a significant contributor to the burden of disease and health care utilization.[4,5] According to the most current Global Burden of Disease (GBD) 2021 data, there were approximately 1.70 billion people living with cirrhosis and other chronic liver disorders in 2021, despite previous estimates that there were about 1.5 billion persons with CLD worldwide.[6-8] The GBD study also found that cirrhosis and other CLDs account for around 46.42 million disability-adjusted life years (DALYs) throughout the world, with approximately 58.4 million incident cases and 1.43 million deaths. These findings indicate that CLD's consequences for public health are increasing globally.[8]

The term "spontaneous bacterial peritonitis" (SBP) refers to an acute infection of ascites, which is an abnormal buildup of fluid in the abdomen that lacks a clear and recognizable cause of infection.[9,10] In patients with cirrhosis who have ascites, SBP is a common and serious consequence that creates an ideal setting for bacterial development. SBP prevalence is high among hospitalized patients (ranged between 10–30%) as compared to outpatients (ranged between 1.5–3.5%). In-hospital mortality can reach 90% if treatment is not received, although early detection and timely antibiotic administration have reduced this rate to about 20%.[11,12]

The SBP is a common and life-threatening complication of CLD, with an increasing prevalence in our population. Early diagnosis and appropriate antibiotic treatment can improve survival rates and reduce complications. Treatment is usually initiated empirically; however, the causative organisms vary across regions and are increasingly developing antimicrobial resistance, while local data remain limited. This study was therefore aimed at determining the current frequency of SBP among patients with CLD in our population and identifying the responsible bacterial pathogens. The findings may help clinicians select effective empirical antibiotics, potentially reducing complications and healthcare costs while improving patients' quality of life.

Methodology

A descriptive cross-sectional study was conducted at the medicine department of Indus Medical College & Hospital, Tando Muhammad Khan, Sindh, from August 2025 to January 2026. The ethical approval was obtained from the ethics review committee of Indus Medical College & Hospital Tando Muhammad Khan via letter number IMC/TMK/ERC/July.2025/5, dated 31-07-2025. Informed consent was obtained from all patients after explaining the objective and purpose of the study and patients were assured that their participation completely voluntary, they could withdraw at any time, and that their decision would have no impact on their treatment. A sample size of 180 patients was calculated using an online sample size calculator (Open Epi), with confidence interval of 95%, margin of error of 7% and drop out of 10%, taking frequency of SBP 29.29% among chronic liver disease patients from a previous study.[13] All the patients aged 35 to 0 years, both male and female patients; diagnosed cases of chronic liver disease for more than 6 months admitted in the medicine department were included. The patients with secondary peritonitis, with ascites due to etiology other than CLD, patients having some intra-abdominal source of infection which needs surgery, patients taking antibiotics for the last month and who were refused to take part in the study were excluded. A chronic liver disease was confirmed with the features of decompensation which were defined by the presence of ascites, jaundice and/or hepatic encephalopathy; and diagnosis was confirmed on presence of coarse echotexture and/or nodular surface of the liver on ultrasound. A patient found with total white blood cells (WBCs) count in ascitic fluid > 500 cells/mm^3 and/or positive ascitic fluid culture was diagnosed with spontaneous bacterial peritonitis. Moderate ascites was confirmed on presence of moderate symmetrical distension of the abdomen with fluid, and gross ascites on presence of marked abdominal distension with fluid. Inpatients admitted visiting medicine department were enrolled using convenience sampling technique. Each patient was subjected to detailed history followed by physical examination. Ultrasound was performed at the time of admission where necessary. Abdominal paracentesis was performed in aseptic environment, for obtaining ascitic fluid for culture and sensitivity and total white blood cells (WBCs) count for confirming SBP. All the data were collected using pre-designed study proforma. Statistical Package for Social Science (SPSS) version 25 was used for interpreting data. The chi-square test was employed to evaluate the categorical variables, while the independent samples t-test was utilized to analyze the continuous variables, with a p-value ≤ 0.05 as significant.

Results

The study population consisted of 180 patients with chronic liver disease (CLD), with a mean age of 49.52 ± 6.55 years. Of these, 103 were male and 77 were female. The mean duration of CLD was 9.49 ± 2.49 months. Ascites was the most common clinical presentation, observed in 81 (45.0%) patients, followed by abdominal pain in 75 (41.7%) and jaundice in 70 (38.9%), as shown in Table I.

The mean white blood cell (WBC) count was 338.87 ± 241.39 cells/mm³. Spontaneous bacterial peritonitis (SBP) was diagnosed in 59 (32.8%) patients with CLD. Among these, 11 patients had positive ascitic fluid cultures. The isolated organisms included Klebsiella species in 4 (2.2%) patients, Escherichia coli in 3 (1.7%), and Acinetobacter species and Streptococcus pneumoniae in 2 (1.1%) patients each. All patients received treatment according to standard guidelines. Overall, 167 (92.8%)

patients showed clinical improvement and were discharged, while 13 (7.2%) died during their hospital stay, as presented in Table II.

Table 1: Baseline and Clinical Characteristics in CLD Patients. (n=180)

Variables		N	%
Gender	Male	103	57.2%
	Female	77	42.8%
Age (years)	Mean ± SD	49.52 ± 6.55	
	35-50	100	55.6%
	51-60	80	44.4%
Duration of CLD		9.49 ± 2.49 months	
Clinical Presentation	Fever	63	35.0%
	Abdominal Pain	75	41.7%
	Moderate Ascites	26	14.4%
	Gross Ascites	55	30.6%
	Jaundice	70	38.9%
	Hepatic Encephalopathy	44	24.4%
	Upper gastrointestinal Bleeding	15	8.3%

No statistically significant association was observed between SBP frequency and gender (p = 0.376) or age (p = 0.282). However, SBP was significantly associated with the duration of CLD, clinical presentation, elevated WBC count, positive ascitic fluid culture, prolonged hospital stay, and mortality (p = 0.001), as shown in Table III.

Discussion

The SBP remains one of the most serious and potentially life-threatening complications of decompensated CLD, specifically among patients with cirrhosis and the ascites.

Table II: Laboratory Findings and Outcome in CLD Patients. (n=180)

Variables		N	%
WBC Count (cells/mm^3)	Mean ± SD	338.87 ± 241.39	
	>500	59	32.8%
Ascitic Fluid Culture	Positive	11	6.1%
Isolated Bacteria	Klebsiella species	4	2.2%
	Escherichia coli	3	1.7%
	Streptococcus pneumonia	2	1.1%
	Acinetobacter species	2	1.1%
SBP	Present	59	32.8%
	Absent	121	67.2%
Hospital Stay		4.08 ± 2.46 days	
Final Outcome at Discharge	Death	13	7.2%
	Improved & discharged	167	92.8%

This study assessed the frequency of SBP and its association with clinical outcomes among cases with CLD, providing insight into the disease burden and its implications for patient prognosis and clinical management. Correspondingly we found frequency of SBP around (32.8%) among 180 patients, that was comparable to the 34.8% (95% CI 30.1–40.2%) reported by Mohammed et al[13], in 319 patients with cirrhosis and ascites in eastern Ethiopia. Consistently in the study by Shah S et al[14] also reported that the SBP was present in 56 (40.3%) out of 139 patients of CLD and ascites. Our findings were further supported by the findings of earlier research by Khan MA et al[15] who reported that, among

Table II: Comparison in SBP and Non-SBP CLD Patients. (n=180)

Variables		SBP		P-Value
		Present	Absent	
Gender	Male	31 (52.5%)	72 (59.5%)	0.376
	Female	28 (47.5%)	49 (40.5%)	
Age groups	35-50	35 (59.3%)	65 (53.7%)	0.478
	51-60	24 (40.7%)	56 (46.3%)	
Duration of CLD (months)		12.53 ± 1.95	8.02 ± 0.83	<0.001
Clinical Presentation	Fever	41 (69.5%)	22 (18.2%)	<0.001
	Abdominal Pain	54 (91.5%)	21 (17.4%)	<0.001
	Moderate Ascites	18 (30.5%)	8 (6.6%)	<0.001
	Gross Ascites	41 (69.5%)	14 (11.6%)	
	Jaundice	52 (88.1%)	18 (14.9%)	<0.001
	Hepatic Encephalopathy	32 (54.2%)	12 (9.9%)	<0.001
	Upper GI bleeding	11 (18.6%)	4 (3.3%)	<0.001
WBC Count (cells/mm^3)	Mean ± SD	659.80 ± 61.42	182.38 ± 98.80	<0.001
	> 500	59 (32.8%)	0 (0.0%)	<0.001
Ascitic Fluid Culture	Positive	11 (18.6%)	0 (0.0%)	<0.001
Isolated Bacteria	Klebsiella species	4 (6.8%)	0 (0.0%)	
	Escherichia coli	3 (5.1%)	0 (0.0%)	
	S. pneumonia	2 (3.4%)	0 (0.0%)	
	Acinetobacter species	2 (3.4%)	0 (0.0%)	
Hospital Stay (days)		7.27 ± 1.65	2.53 ± 0.50	<0.001
Final Outcome at Discharge	Death	13 (22.0%)	0 (0.0%)	<0.001
	Improved & discharged	46 (78.0%)	121 (100.0%)	

110 patients with decompensated CLD presenting with upper GI bleeding reported an SBP frequency of around 30%. Consistently, another study comprising 199 patients with cirrhosis of liver ascites at Gujranwala Medical College demonstrated a SBP prevalence of around 32.2%,[16] almost near to our findings. Comparatively our findings were higher than the 21.4% SBP reported by Duah and Nkrumah in Ghana,[17] and the 19.0% reported by Sindato et al among 269 patients in Tanzania.[18] Such variation reflects differences in the selection criteria of studies populations, along with relatively higher frequency in our population is consistent with the large burden of decompensated CLD in Pakistan, where viral hepatitis is highly prevalent and patients often present late.

In this study, among 59 patients with SBP, ascitic fluid cultures were positive in 18.6% of the cases, with E-coli (5.1%) and Klebsiella species (6.8%) being the most frequently isolated pathogens, consistent with worldwide statistics indicating that Enterobacteriaceae are the primary causes of SBP, as Mahato T et al[19] reported that the ascitic fluid culture grew organism was in 15% of SBP cases, with Klebsiella species in 3 (6.52%) patients, E- coli in 2 (4.35%) cases, streptococcus pneumonia and Acinetobacter in 1 (2.17%) each. Like this study Juhi R et al[19] reported that the most ascitic fluid culture specimens showed no bacterial growth in most samples 82(72.6%) and in culture-positive samples, E-coli was the most frequently isolated organism 10(8.8%), followed by K. pneumoniae 4(3.5%).

According to our study findings in-hospital mortality rate was 22% among patients with chronic liver disease and ascites and it was significantly associated with longer duration of CLD, systemic inflammatory manifestations (fever, abdominal pain), advanced ascites, jaundice, hepatic encephalopathy, upper gastrointestinal bleeding, elevated ascitic leukocyte counts, prolonged hospitalization, and mortality, indicating the SBP as a

major determinant of morbidity and mortality in decompensated cirrhosis in our population. In the comparison of our findings a recent cohort study from the USA involving 4,330 cases with newly diagnosed SBP, by Serper et al[20], reported an in-hospital mortality rate around 15.5%, expanding to 56.6% at 12 months. In the same way, a Taiwanese retrospective cohort of 925 cases demonstrated mortality rates of 10.8%, 23.0%, 44.0%, and 60.9% at 30 days, 90 days, 1 year, and 3 years, respectively. Likewise a recent national study by, Hassan et al. reported some higher rate of in-hospital mortality approximately 27.4% among 223 patients with SBP admitted to a hospital. Overall national and international findings demonstrated that the SBP is a major contributing factor for substantial mortality, specifically among patients with advanced liver disease.

However, variations in mortality rates across studies may be attributed to differences in disease severity, healthcare settings, treatment approaches, patient characteristics, and duration of follow-up. Despite improvements in diagnostic methods and clinical management, the substantial mortality burden of SBP underscores the importance of early recognition, prompt initiation of appropriate antibiotic therapy, and timely management of associated complications to improve patient survival.

This study had several limitations, including its single-centre design, relatively small sample size, and limited follow-up period. Furthermore, the low rate of ascitic fluid culture positivity restricted the assessment of bacterial profiles and antimicrobial resistance patterns. High-risk patients should undergo regular screening, appropriate ascitic fluid analysis, and close monitoring of renal function and other prognostic indicators. Furthermore, larger-scale, multicentre prospective studies are recommended to identify local risk factors, evaluate treatment outcomes, and develop effective strategies to reduce SBP-related mortality.

Conclusion

The spontaneous bacterial peritonitis observed highly prevalent among hospitalized patients with chronic liver disease, and strongly linked to progressive hepatic decompensation, prolonged hospitalization, and mortality. Performing diagnostic paracentesis as a routine, initiating timely empiric therapy based on local bacterial trends, and following preventive protocols are key to improving outcomes. Early identification of SBP and directing efforts toward patients at higher risk could help lower SBP-related complications and deaths, especially in healthcare-limited settings.

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