INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Review Paper

Evaluation of Clinical Outcomes and Quality of Care in Patients with Spontaneous Bacterial Peritonitis

Srinivas S K*, P. Suriya, A. Muthukumar

Department of Pharmacy Practice, KMCH College of Pharmacy, Coimbatore, Tamilnadu.

ARTICLE INFO

Published: 03 July 2026
Keywords:
spontaneous bacterial peritonitis; liver cirrhosis; clinical outcomes, quality of care, albumin, acute kidney injury, multidrug resistance, mortality, antibiotic prophylaxis, ascites..
DOI:
10.5281/zenodo.21156740

ABSTRACT

Spontaneous bacterial peritonitis (SBP) is a potentially lethal, but often fatal, infection of ascitic fluid that can occur in patients with portal hypertension and liver cirrhosis with a high level of morbidity and mortality. This narrative review brings together findings of 35 original publications that had been published between 1997 and 2025 to assess clinical outcomes and quality of care in SBP patients. We discuss the epidemiology and pathophysiology of SBP, diagnostic methods, microbiological trends (including the increase of multidrug-resistant (MDR) organisms) and treatment therapies, role of albumin infusion, prevention of acute kidney injury and hepatorenal syndrome, quality-of-care indicators, adherence to guidelines and prognostic scoring systems. The mortality rate is between 8 percent and 35 percent in-hospital and one-year mortality in the majority of cohorts is over 50 percent. Major therapeutic challenge is the development of MDR bacteria where 30-50% of cases in current reports are culture positive. Albumin infusion is an important method of renal impairment and mortality reduction. There is still poor compliance to guidelines with high disparities in albumin utilization, early paracentesis and prophylaxis. Better outcomes in SBP require greater focus on improving the standardized care protocols, antimicrobial stewardship, and early diagnostic paracentesis.

INTRODUCTION

Spontaneous bacterial peritonitis (SBP) is one of the most hazardous side effects of liver cirrhosis and it is an infection of the ascitic fluid without a surgically treatable intraabdominal etiology. Since the 1960s and 1970s, Since then, SBP has proved to be an important outcome predictor in ascites patients with cirrhosis. Portal hepatic hypertension, reduced hepatic reticuloendothelial activity and an impaired intestinal mucosal barrier contribute to bacterial translocation across the gut lumen into the peritoneal space in patients with advanced cirrhosis. The clinical impact of SBP

***Corresponding Author:** Srinivas S K
Address: *Department of Pharmacy Practice, KMCH College of Pharmacy, Coimbatore-641048.*
Email ✉: Saravanasrinivas6@gmail.com
Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

epidemiology is impressive. Ascetic rates of 10-30 in hospitalized cirrhotic cases are consistently published in research and in-hospital mortality ranging between 8 and 35 percent by demographic and time.

Prognosis is also not good in the long run: in most cohort studies, one-year mortality is over 50 percent, not only due to the severity of the initial infection itself but also due to hepatic decompensation that it causes. In a groundbreaking national cohort of 4,330 SBP patients of the Veterans Health Administration there was a mortality rate of in-hospital mortality at 15.5% and 12-month mortality of 56.6, which highlights the continued lethality of the condition in spite of medical treatment improvements (Serper et al., 2025).

Clinical treatment of SBP has significantly changed since the early identification of the disease. The development of third-generation cephalosporins, mainly cefotaxime, as the empiric choice of therapy was followed by the seminal progress in therapy with survival advantage as shown by a randomized controlled trial by Sort et al. (1999) on using intravenous albumin infusion. However, in spite of these changes, there are still major challenges. The development of multidrug-resistant (MDR) organisms as the etiologic agent of SBPPatient outcomes are however undermined by the development of hepatorenal syndrome (HRS) and acute kidney injury (AKI), two devastating outcomes, as well as inappropriate compliance with the evidence-based therapy recommendation. Quality of care in the field of SBP has many aspects: in-time diagnostic paracentesis, correct choice of empiric antibiotics, albumin infusion, secondary prophylaxis, and renal complication surveillance. Research into quality indicators has found a wide range of practice and research has also found that less than 30 percent of the eligible patients are actually undergoing albumin therapy of the type recommended by the guidelines and that delayed paracentesis is a factor that is directly related to mortality. The given gaps highlight the necessity of organized quality improvement initiatives and on-going clinical studies. The current narrative review will be intended to generalize the current evidence base of clinical outcomes and quality of care in SBP. Based on 35 original articles that represent almost thirty years of research results, we discuss the pathophysiology, microbiology, diagnosis, treatment, complications, prognostic devices, and quality improvement measures that are applicable in SBP management. We aim to deliver a synthetic synthesis, which is clinically oriented and provides information to inform both the practice and the research directions.

2. Epidemiology and Pathophysiology

2.1 Prevalence and Incidence

One of the most common bacterial infections in the given community is SBP, in which the infection occurs in 10-30 per cent of cirrhotic patients hospitalized with ascites. The landmark meta-analysis by Arvaniti et al. (2010) showed that infections in cirrhosis are increased four-fold, and, therefore, SBP and other bacterial infections are definitive determinants of prognosis and not complications. Although patients with severe cirrhosis, particularly with low ascitic fluid protein levels below 1.5 g/dL, have an annual incidence rate of up to 20-30 cases, the prevalence of SBP in patients with multicenter incidences of index ascites hospitalization is about 10-18%. The temporal patterns of epidemiology of SBP show the shifts in the underlying population with cirrhosis, and trends in the use of antimicrobials. Investigating both short and long-term mortality rates among 925 Taiwanese SBP patients over a cohort, Hung et al. (2024) have discovered that despite a slight improvement of the overall survival rate of this group under the conditions of

modern treatment, the size of the mortality burden is significant. On the same note, The demographics of the SBP population can also be shifting because of the increase of metabolic-associated steatohepatitis and non-alcoholic fatty liver disease as causes of cirrhosis.

2.2 Pathophysiological Mechanisms

There are also complex roles of intestinal bacterial overgrowth, increased intestinal permeability, and altered local and systemic immune systems in the pathophysiology of SBP, and disturbed mesenteric lymphatic drainage. Garcia-Tsao and Wiest (2004) have offered a complete framework of attributing the role of gut microflora in the pathogenesis of cirrhotic complications with special emphasis on bacterial translocation being The main mechanism behind SBP which is followed by the move of live bacteria or bacterial products of the intestinal lumen to the mesenteric lymph nodes and subsequent to the systemic circulation. In progressive cirrhosis, several factors favor the process of bacterial translocation: the small intestine becomes overgrow with bacteria due to intestinal dysmotility, the intestinal tight junctions become loose, and the intestinal immune system is severely dysfunctional with the loss of secretory immunoglobulin A and the functioning of the mucosal macrophages. When the bacteria enter the ascitic fluid the ability of the peritoneum to eliminate the infection is compromised due to low levels of complement, low opsonization levels as well as poor functioning of the neutrophil in case of patients with severe hepatic dysfunction. All these mechanisms precondition the development of SBP and contribute to understanding why those patients with low ascitic fluid protein are in the danger in a specific way.

SBP-induced systemic inflammatory response, in its turn, preconditions an inflammatory cascade of hemodynamic and renal events. Splanchnic vasodilation caused by the release of bacterial lipopolysaccharide and other pathogen-associated molecular patterns increases the action of vasoconstrictive and antidiuretic hormones and reduces the effective arterial blood volume even more. This hemodynamic disturbance on top of already poor renal perfusion in advanced cirrhosis contributes to the development of AKI and HRS, the primary mediators of SBP-associated mortality.

3. Diagnosis of Spontaneous Bacterial Peritonitis

3.1 Diagnostic Criteria and Paracentesis

Diagnostic paracentesis is performed to retrieve ascitic fluid that is analyzed in order to reach the diagnosis of SBP. Current international guidelines on SBP are based on a polymorphonuclear (PMN) cell count of 250 cells per mm3 or more in ascitic fluid, in the absence of a surgically correctable intraabdominal source, as dictated by the current international guidelines of the American Association for the Study of Liver Diseases (AASLD) and the European Association for the Study of the Liver (EASL). This cutoff point indicates the realization that PMN-based diagnosis provides a possibility of empirical treatment without the culture findings and that the bacterial culture can be negative in up to 60-70 percent of patients because of the low bacterial inoculum of the ascitic fluid.

The time during which paracentesis is diagnosed has major prognostic implications. Kim et al. (2014) provided a retrospective study of 239 SBP patients and established that early paracentesis, performed within 12 hours of admission, was independently associated with reduced in-hospital mortality. Notably, each hour of delay in paracentesis was correlated with a 3.3% more mortality increase, which demonstrates that diagnostic delay is a manageable outcome-driving factor. This finding has been used as basis to

develop quality improvement initiatives that demand immediate paracentesis as one of the performance indicators in the management of cirrhosis. Most importantly, every hour of delay during paracentesis was correlated with the 3.3% rise in mortality, which placed diagnostic delay as a determinant with a hand to be modified. This conclusion has given rise to quality improvement activities that have required timely paracentesis as one of the core performance measures in the management of cirrhosis.

3.2 Culture Techniques and Microbiological Yield

The positivity rates of Ascitic fluid culture differ significantly amongst the studies with an average rate of 34 to 52. A retrospective analysis of 233 SBP episodes across 10 years gave a 34.4% culture positivity value, which is in harmony with the long-known weakness of traditional culture methods in identifying the low-density bacteremia typical of SBP (Soares et al., 2020). Bedside collection of ascitic fluid into the blood culture bottles instead of in the laboratory has increased yield and is one of the quality practice recommendations.

In a retrospective study involving 233 episodes (Garcia-Tsao et al., 1996) and a series of 144 episodes (Pascual et al., 1997), the basic information on the microbiological profile of SBP was determined, showing Gram-negative enteric bacteria as the predominant ones, Escherichia coli and Klebsiella pneumoniae. These organisms explain about 60-70% of culture-positive incidences of SBP in historical series giving the microbiological explanation of third-generation cephalosporin empiric treatment. As explained below, however, this microbial milieu has been changed significantly with the introduction of antibiotic-resistant organisms in modern practice.

4. Microbiology and Antimicrobial Resistance

4.1 Evolving Microbiological Profile

A common universal observation amongst modern retrospective studies is a change in microbiological profile of SBP toward an increased level of heterogeneity with a growing proportion of Gram-positive microorganisms and MDR strains. In a retrospective study of 100 SBP patients, U et al. (2024) validated E. coli as the overriding pathogen and reported MDR organisms in 5% of cases and that ACLF patients who were encountered with MDR infection had death rates of almost 89. A high series of 721 cases by Baskaran et al. (2020) documented a 38.2% culture positivity rate, with 42% of the culture positives carrying MDR organisms, which is substantially high compared to rates in older series.

MDR bacteria were detected in 28.6% of 302 patients of the ascites in the Polish epidemiological study of SBP pathogens covering 2017-2024, and the proportion of Gram-positive pathogens became a majority in some facilities. Bauer et al. (2016) also reported MDR bacteria in 31.7% of 63 culture-positive SBP, where the proportion of Gram-positive cocci, such as Staphylococcus aureus and Enterococcus species, which are usually not included in standard cephalosporin-based empiric regimens, grew significantly.

4.2 Extended-Spectrum Beta-Lactamase Producing Organisms

The most clinically relevant microbiological change in the treatment of SBP is probably the appearance of extended-spectrum beta-lactamase (ESBL)-producing Enterobacteriaceae. A seminal matched case-control study conducted by Park et al. (2009) demonstrated that ESBL-producing E. coli and Klebsiella species became the cause of SBP with significantly worse clinical outcome than non-ESBL causing infections that had a

higher tendency to fail treatment, develop AKI, and cause mortality.

Oliveira et al. (2019) reported that 183 SBP samples of cirrhotic patients contained high rates of MDR bacteria: 46.9 and 38.9 percent of MDR and third-generation cephalosporin resistance, respectively. These statistics undermine the use of cefotaxime or ceftriaxone as empiric therapy across the board, especially in healthcare-related and nosocomial SBP where MDR is most common. The risk factors of MDR SBP are previous exposure to antibiotics, recent hospitalization, invasive operations, and nosocomial infections.

4.3 Implications for Empiric Antibiotic Selection

Fernandez et al. (2002) provided the foundation to the understanding of the mechanisms of antibiotic selection pressure to produce resistance because they produced the basic evidence on the epidemiological alterations of the bacterial infections in cirrhosis associated with invasive operations and norfloxacin prophylaxis.

Current guidelines now suggest that SBP episode risk stratification be considered in three categories community-acquired, healthcare-associated, and nosocomial categories with increased empiric regimens, such as carbapenem-based or piperacillin-tazobactam-based, applied to high-risk episodes.

Importantly, Soares et al. (2020) reported a paradoxical finding that the use of piperacillin-tazobactam was worse compared to third-generation cephalosporins in their 10-year retrospective cohort study, which could be due to confounding by indication, meaning that broader-spectrum agents are used in more ill patients or those with a prior history of treatment failure. This observation highlights the fact that antimicrobial stewardship in SBP is a complex issue, and that future research is required to inform the choice of empiric regimens in the modern period of antimicrobial resistance.

5. Treatment Strategies

5.1 Antibiotic Therapy

The third-generation cephalosporins, especially intravenous cefotaxime 2 g each 8-12 hours, continue to be the mainstay of empiric therapy of community-acquired SBP founded on previous efficacy statistical records showing a resolution rate of 75-90% and the positive safety profile in patients with hepatic dysfunction. Five days of treatment is proven to be as effective as ten days in randomized trials, which is typical of the quick bacteriological response in case of appropriate use of antibiotics. Oral ofloxacin has demonstrated to be an effective substitute to intravenous cefotaxime in uncomplicated community-acquired SBP in the absence of renal dysfunction, encephalopathy, GI bleeding or severe hepatic dysfunction, but an increase in fluoroquinolone resistance makes its use less useful in populations where there is prior exposure to prophylactic norfloxacin use.

The effectiveness of the empirical antibiotic therapy can be considered as one of the key factors which affect the result because the effective empirical antibiotic therapy means the application of the antibiotic which has in vitro activity against the pathogenic bacteria. Investigations that study the occurrence of treatment failure always report improper initial antibiotics to be an independent predictor of mortality and poor therapy to be linked with two to three times of the risk of mortality. The clinical imperative behind this relationship is to support empiric regimen choice with the local MDR antimicrobial resistance trends and patient-specific risk factors that contribute to MDR infection.

5.2 Albumin Infusion: The Landmark Evidence

The use of intravenous albumin in combination with antibiotics is the greatest therapeutic development in the management of SBP since the discovery of effective antibiotics. In the New England Journal of Medicine, Just St. et al. (1999) published the groundbreaking randomized controlled trial that showed that albumin infusion of 1.5 g/kg on day 1 and 1 g/kg on day 3 of SBP diagnosis was significantly more effective than the antibiotic therapy alone in reducing the number of patients developing renal impairment (10% vs 33% $p<0.001$) and in-hospital mortality (10% vs 29% $p<0.01$). These findings were very strong indicators that the positive action of albumin did not only perform its oncotic roles but also anti-inflammatory and immunomodulatory actions.

These findings have been replicated by subsequent meta-analyses. Sigal et al. (2013) were able to combine the results of four randomized trials that showed that albumin infusion was linked to large decreases in renal impairment and mortality as well as Batool et al. (2022) meta-analysed randomised controlled trials that indicated that the rates of 30-day mortality and renal impairment were significantly lower when an albumin infusion was used. Even with such quality evidence base, practical application of albumin in SBP patients is pathetically low and highly inconsistent.

As was demonstrated by Serper et al. (2025) based on the national group of Veterans Health Administration, there are marked racial and regional differences in albumin use among SBP patients, and there is underutilization, as compared with guidelines. The authors discovered that albumin receipt was linked to significantly better outcomes, which highlights that evidence-practice gap is a quantifiable and avoidable contributor to the additional mortality. In a retrospective study of 49 patients on low-dose albumin (30 g/day), Jouirou et al. (2019) found that 18.3 are experiencing AKI and 4 are dying, which indicates that even lower-dose albumin may be clinically beneficial in the chosen patient groups.

6. Complications: Acute Kidney Injury and Hepatorenal Syndrome

6.1 Incidence and Mechanisms of AKI in SBP

Acute renal damage is the most important determinant of short-term prognosis and it happens in 3040% of SBP patients. The independent predictor of death in cirrhosis patients with SBP that was found to be the most significant one by Tandon and Garcia-Tsao (2011) was renal impairment with even the slightest increases in serum creatinine levels providing a large portion of the risk of death. The ICA-AKI criteria which includes dynamic changes in serum creatinine within a time span of 48 hrs have enhanced the prompt diagnosis and staging of AKI among this population.

Sohn et al. (2020) used a retrospective cohort study to assess the impact of AKI by ICA-AKI criteria on the long-term outcomes of SBP and reported that 90-day and one-year mortality rates were independently correlated with the existence and the severity of AKI. The research emphasized the prognostic value of AKI staging and stage 2-3 AKI has a dismal prognosis. A retrospective study of 218 patients who were admitted to ICU with cirrhosis and SBP measured revealed that AKI, MELD-Na score, and septic shock were the key predictors of in-hospital mortality that occurred within 50 days and that renal dysfunction is central to predicting SBP (Bal et al., 2016).

6.2 Hepatorenal Syndrome

Hepatorenal syndrome is the most serious variant of AKI in SBP, and the functional renal failure with no underlying renal pathology, which is caused by extreme renal vasoconstriction under the conditions of generalized vasodilation and practical arterial volume loss. The incidence of HRS is about 10-20 percent in non-albinised SBP

patients versus 5-10 percent in those albinised receiving albumin infusion, and this gives the pathophysiological support to the survival advantage of albumin. The causes of AKI, including hypovolemia, should be eliminated to diagnose HRS-AKI. nephrotoxic drugs, parenchymal renal disease and urinary obstruction, and is founded on the inability of renal failure to respond to fluid challenge.

Albumin infusion prevention of HRS is much more effective than treatment, as already developed HRS has a median survival of weeks to months without liver transplant, or renal replacement therapy. Research shows that the positive action of albumin in SBP is not only volume expansion based, but also directs anti-inflammatory action, which is associated with alleviation of oxidative stress, regulation of endothelial actions, and bacterial lipopolysaccharide binding. These processes can be used to explain why the timing of administration of albumin is important and it is most beneficial when the albumin is administered at the same time as the onset of antibiotic therapy instead of waiting until the signs of renal dysfunction appear.

7. Prognosis and Predictive Models

7.1 Determinants of Short-Term Mortality

Probably the most important factors which affect short-term mortality in SBP are the degree of renal dysfunction, the hemodynamic response to infection, and the severity of underlying liver disease. Several retrospective studies have found some predictors of in-hospital and 30-day mortality which are consistent. A study by Elizouki et al. (2021) was a retrospective cohort study that included 61 patients with a first episode of SBP, where Cox regression analysis was utilized to determine that the significant independent transition of serum bilirubin, creatinine, and Child-Pugh score were important predictors of short-term mortality. In a similar manner, prothrombin time was found by early retrospective studies by Pascual et al. (1997) to be an important outcome determinant, which is much in line with the central role of hepatic synthetic activity.

In a retrospective cohort study of 178 patients with a 13-year follow-up, Lim et al. (2023) reported a 12-month survival of only 32% and named serum creatinine as the most crucial prognostic indicator, which is in line with the paradigm of renal dysfunction becoming the most significant determinant of SBP outcomes. Poca et al. (2016) designed and tested a mortality predictive model in SBP patients and showed that a combination of hepatic, renal, and inflammatory biomarkers has the incremental prognostic value. Alaniz and Regal (2009) emphasized the usefulness of routinely available inflammatory and biochemical biomarkers such as neutrophil-to-lymphocyte ratio (NLR) and CRP-albumin ratio that could predict the 30-day mortality in SBP.

7.2 MELD Score and Other Prognostic Systems

Model end stage liver disease (MELD) score which uses bilirubin, creatinine, and INR, has become the most validated prognostic instrument in cirrhosis and it is reliably related with SBP in modern cohorts. Schwabl et al. (2015) established that MELD score also had independent predictive ability of SBP development in the presence of ascites in cirrhotic patients, and subsequent death after infection. The MELD-Na version that includes serum sodium that represents neurohormonal activation offers some more prognostic data, especially in the hyponatremia environment, which is prevalent in late cirrhosis.

In a retrospective study of 450 cases of SBP, Wulandari et al. (2021) created and validated a prognostic nomogram on one-year survival following first-ever SBP that included MELD

score, serum albumin, ascitic fluid PMN count, and response to initial antibiotic therapy. The nomogram had good discriminative and calibration skills and represented a feasible clinical tool in a risk stratification and patient counseling. The effect of acute-on-chronic liver failure (ACLF) on the outcome of SBP has also been established as a significant factor: U et al. (2024) found that mortality was nearly 89% in patients with acute liver failure and resistant infection, which is the most disastrous combination.

7.3 Long-Term Mortality and Recurrence

Most cohort studies indicate that the one-year mortality rate following the initial episode of SBP exceeds 50 percent, which indicates the high incidence of reoccurrence of infections and hepatic events besides the prognostic value of SBP as a marker of decompensated cirrhosis. Abdel-Razik et al. (2020) reported the discovery of novel predictors of SBP recurrence in a prospective-retrospective cohort study, 12 months follow-up revealed that MDR infection at the initial episode, insufficient secondary prophylaxis, and persistent ascites were significant predictors of recurrent SBP. The significance of long-term outcome monitoring is supported by Hung et al. (2024), who reported that even in the case of initial survivors, the likelihood of subsequent death is high during the first year of follow-up, which highlights the necessity of a long-lasting follow-up of cirrhosis complications and their proactive treatment.

8. Quality of Care and Guideline Adherence

8.1 Quality Metrics in SBP Management

SBP Quality of care has various quantifiable areas that are in line with evidence-based practice guidelines. The main quality indicators are as follows: timely diagnostic paracentesis (within 12 hours of presentation); the correct choice of empiric antibiotics according to risk stratification; albumin infusion according to the recommended dose and schedule; early detection and treatment of AKI and HRS; secondary prophylaxis with oral norfloxacin or trimethoprim-sulfamethoxazole under the influence of SBP-related assessment; and liver transplant candidacy. The authors showed that the ability to adhere to the quality measures in cirrhosis care, including the SBP-related measures, was also independently related to lowering all-cause mortality and healthcare utilization, which is strong evidence of the clinical utility of quality improvement programs (Serper et al., 2019).

In spite of the obvious evidence base, the actual compliance with the SBP quality measures is still sub-optimal, in a range of healthcare systems and nations. A review and quality improvement study of 126 patients by Tagliaferri and Ansari (2024) revealed that only 26 percent of the patients received proper SBP prophylaxis before the quality improvement intervention; under the quality improvement, the rate of prophylaxis and outcomes were elevated. Dinis-Ribeiro et al. (2000) assessed compliance to a SBP treatment approach in special liver units and reported improved results in those institutions with defined protocols versus those with no designed paths of managing interventions.

8.2 Disparities in Care

Even in present-day literature, significant racial, geographic, and socioeconomic differences in the quality of SBP care have been reported. Serper et al. (2025) found that there are significant disparities in the application of albumin in different geographic areas in the United States, in which racial minority patients are less likely to have an albumin infusion, recommended by guidelines, regardless of the severity of the disease. Such differences in process measures had a direct connection with the differences in mortality outcomes implicating inequitable care

delivery as a factor in the outcome of disparities in survival with SBP.

The reasons behind care disparities in SBP are multifactorial and involve the lack of knowledge of the provider, institutional resources, lack of adequate protocols or order sets, and systemic issues that influence communication and healthcare access. Interventions have been suggested and piloted, such as standardized order sets, clinical decision support tools and mandatory bundles of paracentesis, to help cut variation and enhance the implementation of evidence-based care in a wide range of clinical settings.

8.3 Early Paracentesis as a Quality Measure

Prompt diagnostic paracentesis and improved survival in SBP is one of the best quality-outcome correlations in hepatology. In developing a dose-response relationship between process and outcome, Kim et al. (2014) built an argument that early paracentesis is a mandatory quality parameter, demonstrating that the longer the diagnostic paracentesis was delayed, the higher the in-hospital mortality rate (3.3 per cent per hour). However, a large percentage of eligible patients fail to receive timely paracentesis as availed by the survey of clinical practice with obstacles that include some patients being identified with SBP risk too late, procedural constraints, and the issue of the system that is an after-hours provision of paracentesis services.

Efforts to improve quality of care related to early paracentesis have utilized multiple interventions, such as electronic health record alerts, protocols to begin paracentesis initiated by the nurse, and orders of bundled SBP care triggered at admission among the cirrhotic patients with ascites. Serper et al. (2019) have discovered that greater compliance with quality practices, such as timely paracentesis, at VA medical facilities was linked with a markedly lower one-year mortality and less 30-day readmission rate, which is empirically supported as an investment in quality improvements at the systems level to SBP care.

9. Prevention and Prophylaxis

9.1 Primary Prophylaxis

Primary prophylaxis against SBP should be given to cirrhotic patients with a total protein level in the ascitic fluid that is below 1.5 g/dL and has either a renal impairment (defined as creatinine of 1.2 mg/dL or higher, BUN of 25mg/dL or higher, or serum sodium of 130meq/L or lower) or a Child-Pugh score of 9 or greater and bilirubin of 3 mg/dL or more. Norfloxacin 400 mg per day is the most common and it has been proved to reduce the number of SBPs/year in high-risk patients by about 20 to 7%. The benefit process is through intestinal decontamination, which selectively reduces gram-negative aerobic intestinal microflora, leading to bacterial translocation; anaerobic microflora that forms a barrier to pathogenic organism colonization is preserved.

Long-term norfloxacin prophylaxis though effective in reducing SBP episodes, the theoretical risk of selection of resistant organisms makes it more difficult to manage breakthrough infections. Fernandez et al. (2002) recorded shifts in the epidemiology of bacterial infections in quinolone prophylaxis related cirrhosis which included heightened ratio of quinolone-resistant organism and Gram-positive bacteria. This issue has drivenandonate prophylaxis interest in alternative prophylaxis and the highest-risk patients as established by validated risk scores.

9.2 Secondary Prophylaxis and Recurrence Prevention

The one-year recurrence rate of SBP in one episode with no secondary prophylaxis is approximately 70% (following the initial episode), which forms a strong argument in support of the use of indefinite antibiotic prophylaxis in SBP survivors. At a daily dose of 400 mg, norfloxacin

has been demonstrated to lower the incidence of recurrence as well as to increase the survival time of cirrhotic patients who have recovered SBP. Since recurrent SBP correlates with increasingly increased mortality rate in proportion of each event, secondary prophylaxis is an urgent and under-used intervention in the management of long-term cirrhosis.

Tagliaferri and Ansari (2024) discovered that of all the eligible patients, 26% received relevant prophylaxis during their pre-intervention period even with the high guideline strength recommendation. Some of the causes of underuse of secondary prophylaxis include absence of official discharge protocols, non-adherence among patients and uncertainty of providers regarding the indication levels and time. Interventions involving quality improvement interventions, which involve the inclusion of secondary prophylaxis within the framework of discharge order sets, have been found to enhance adherence and lower the readmission rates of recurrent SBP.

10. Future Directions and Emerging Evidence

The sphere of SBP management is developing actively and is responding to the clinical issues of antimicrobial resistance, the identification of ACLF as a specific and devastating syndrome, or the understanding of the gut-liver axis. There are various issues which require specific research interest in the future.

To begin with, the most effective empiric antibiotic regimen of nosocomial and healthcare-associated SBP in the era of MDR organisms prevalence needs to be prospectively tested. Comparative randomized trials of standard third-generation cephalosporin therapy versus broader-spectrum therapy stratified by MDR risk factors are required to establish evidence-based escalation guidelines without encouraging the use of broad-spectrum antibiotics in lower-risk nosocomial cases.

Second, bacterial microbiota transplantation and other gut microbiome-focused interventions are also a promising future as initial evidence shows that microbial diversity restoration can decrease risks of infection in patients with cirrhosis. Third, the creation and testing of fast molecular diagnostic systems that can detect causative organisms and resistance determinants within hours instead of days has the potential to provide targeted antimicrobial therapy sooner into the clinical course, which can improve outcomes of individual patients and antimicrobial stewardship. Fourth, the use of machine learning and artificial intelligence on the electronic health record data can possibly allow identifying the cirrhotic patients with the highest risk of SBP on a real-time basis, which can trigger proactive diagnostic and prophylactic measures. Such systems of clinical decision support are under investigation to determine their effects on the outcomes and SBP incidence in multiple academic centers.

CONCLUSION

Spontaneous bacterial peritonitis is one of the primary complications of liver cirrhosis with high rates of short-term and long-term mortality despite the improvement of both diagnostic tests and treatment methods. This review of 35 original articles is a narrative study that demonstrates a overall pattern of evidence with multiple major conclusions. To begin with, in-hospital mortality in SBP is 8% 35% with one-year mortality is regularly over 50-percent, which depicts the severity of the underlying cirrhosis as well as the lethality of the infection. Second, microbiological profile of SBP has changed significantly towards MDR organisms that have become prevalent (28-47) in series since the era of culture positivity, and are independent predictors of worse outcome and higher mortality. Third, the most effective adjunctive therapy concern is albumin infusion at recommended doses which has a major impact on

reducing AKI, HRS, and mortality but is highly underutilized in clinical practice among various healthcare systems.

Fourth, the quality of care in SBP is described by a high level of discrepancy in the adherence to evidence-based practices, such as the timely administration of paracentesis, the correct choice of empiric antibiotics, the infusion of albumin, and secondary prophylaxis. Such deficiencies in care quality have a direct connection with avoidable mortality and form significant health system-level intervention targets. Fifth, renal dysfunction, serum creatinine, AKI staging using ICA-AKI criteria, and HRS development is the strongest and the most consistent predictor of short-term mortality, which underlines the importance of the early detection and intensive prevention and treatment of renal complications.

Collectively, these results suggest the need to implement complex interventions to enhance SBP outcomes: standardized clinical bundles with early paracentesis bundles and required albumin orders; antimicrobial stewardship programs with risk-based empiric regimen risk-stratification and mandatory postdischarge surveillance of microbiological trends to facilitate therapeutic changes. To convert the current evidence base to the provision of consistent, equitable, high-quality care to this vulnerable group of patients, investment in quality improvement infrastructure, such as clinical decision support instruments and provider as well as institution-level performance feedback, is required.

REFERENCES

1. Serper M, et al. (2025). "Clinical Outcomes and Care for Spontaneous Bacterial Peritonitis: A National Cohort Study." *Hepatology.* PMID: 39879583. *(National VHA cohort; 4,330 SBP patients; in-hospital mortality 15.5%, 12-month mortality 56.6%)*
2. Hung T-H, et al. (2024). "Short and Long-Term Mortality of Spontaneous Bacterial Peritonitis in Cirrhotic Patients." *Medicine.* PMID: 39686510. *(Retrospective Taiwanese cohort; N=925; mortality trends over time)*
3. Lim KH, Potts JR, et al. "Outcomes after Hospitalisation with Spontaneous Bacterial Peritonitis over a 13-Year Period: A Retrospective Cohort Study." *Journal of Digestive Diseases.* PMID: 36827533. *(178 patients; 12-month survival 32%, creatinine key predictor)*
4. Bal CK, Daman R, Bhatia V. (2016). "Predictors of Fifty Days In-Hospital Mortality in Decompensated Cirrhosis Patients with SBP." *World Journal of Hepatology.* PMID: 27134704. *(218 ICU patients; AKI, MELD-Na, and septic shock as predictors)*
5. Elzouki AN, et al. (2021). "Predictors of Short-Term Mortality Following First Episode of SBP in Hospitalized Cirrhotic Patients." *Cureus.* PMID: 34753000. *(Retrospective cohort; 61 patients; Cox regression survival analysis)*
6. Jepsen P, et al. (2023). "Spontaneous Bacterial Peritonitis Mortality Trends in the Last Decade." *PubMed.* PMID: 34007340. *(Retrospective 72 patients; prothrombin time, bilirubin, creatinine as mortality predictors)*
7. Wulandari LB, et al. (2021). "Development and Validation of a Prognostic Model for One-Year Survival of Cirrhosis Patients with First-Ever SBP." *Journal of Clinical and Translational Hepatology.* PMID: 34722179. *(Retrospective nomogram development; N=450 SBP cases)*
8. Tandon P, Garcia-Tsao G. (2011). "Renal Dysfunction is the Most Important Independent Predictor of Mortality in Cirrhotic Patients with SBP." *Clinical*

Gastroenterology and Hepatology. PMID: 21145427.

9. Pascual J, et al. (1997). "Spontaneous Bacterial Peritonitis: Clinical, Microbiological and Clinical Course Study of 144 Episodes." *Revista Española de Enfermedades Digestivas.* PMID: 9141899. *(Retrospective 144 episodes; 8.33% mortality; prothrombin time predictor)*
10. García-Tsao G, et al. (1996). "Spontaneous Bacterial Peritonitis: Clinical and Microbiological Study of 233 Episodes." *Gastroenterología y Hepatología.* PMID: 8957729. *(Retrospective 233 episodes; 15.45% mortality; Gram-negative predominance)*
11. Serper M, et al. (2025). "Albumin for Spontaneous Bacterial Peritonitis: Care Variation, Disparities and Outcomes." *PMC/Hepatology Communications.* PMC12066798. *(Racial disparities in albumin use; regional variation nationally)*
12. Tagliaferri A, Ansari N. (2024). "The Use of Antibiotics for the Prophylaxis of SBP: A Retrospective Review and Quality Improvement Study." *GastroHep. (126 patients; only 26% received appropriate prophylaxis; improved mortality with prophylaxis)*
13. Serper M, Kaplan DE, et al. (2019). "Quality Measures, All-Cause Mortality, and Health Care Use in a National Cohort of Veterans with Cirrhosis." *Hepatology.* PMID: 31009067. *(Bundled quality metrics for cirrhosis care including SBP)*
14. Kim JH, et al. (2014). "Early Paracentesis and In-Hospital Mortality in Patients with SBP." *(Retrospective 239 patients; early paracentesis within 12 hours → lower mortality; each hour delay = 3.3% increased mortality)*
15. Dinis-Ribeiro M, et al. (2000). "Spontaneous Bacterial Peritonitis in Patients with Hepatic Cirrhosis: Evaluation of a Treatment Protocol at Specialized Units." *Hepatogastroenterology.* PMID: 11100352.
16. Sort P, Navasa M, Arroyo V, et al. (1999). "Effect of Intravenous Albumin on Renal Impairment and Mortality in Patients with Cirrhosis and SBP." *New England Journal of Medicine.* PMID: 10432325. *(Landmark RCT; albumin 1.5 g/kg day 1 + 1 g/kg day 3; reduced HRS and mortality)*
17. Sigal SH, et al. (2013). "Albumin Infusion Improves Outcomes of Patients with SBP: A Meta-analysis of Randomized Trials." *Clinical Gastroenterology and Hepatology. (4 RCTs; pooled analysis showing reduced renal impairment and mortality)*
18. Batool S, et al. (2022). "Efficacy of Intravenous Albumin for SBP Among Patients with Cirrhosis: A Meta-Analysis of Randomized Control Trials." *Cureus.* PMC: 9884405. *(30-day mortality and renal impairment significantly lower with albumin)*
19. Sohn W, Kim JH, Cho JY. (2020). "Effect of Acute Kidney Injury on Long-Term Outcomes of SBP Using ICA-AKI Criteria." *Journal of Gastroenterology and Hepatology.* PMID: 31816662.
20. Jouirou B, et al. (2019). "Effect of Low Dose Albumin Administration in SBP on Renal Function and Survival." *PubMed.* PMID: 31759874. *(Retrospective; 49 patients; 30 g/day albumin; HRS in 18.3%; mortality 4%)*
21. U LK, et al. (2024). "Spontaneous Bacterial Peritonitis: Etiology, Microbiology, and Clinical Outcomes in Cirrhosis Patients." *Cureus.* PMID: 39898135. *(100 patients; E. coli dominant; MDR in 5%; ACLF mortality 89%)*
22. Baskaran V, et al. (2020). "Microbiological Profile of Pathogens in SBP Secondary to

Liver Cirrhosis: A Retrospective Study." *PubMed.* PMID: 32070221. *(721 cases; 38.2% culture positivity; 42% MDR; E. coli most common)*

23. Oliveira JC, et al. (2019). "High Prevalence of Multidrug Resistant Bacteria in Cirrhotic Patients with SBP: Is It Time to Change the Standard Antimicrobial Approach?" *Canadian Journal of Gastroenterology and Hepatology. (183 SBP samples; 46.9% MDR; 3GC resistance 38.9%)*
24. Soares EC, et al. (2020). "A Retrospective Analysis of Cases of SBP in Cirrhosis Patients." *PLOS ONE.* PMID: 32986728. *(10-year single-center study; 17.8% mortality; 34.4% culture positive; piperacillin-tazobactam worsened outcomes)*
25. Fernández J, et al. (2002). "Bacterial Infections in Cirrhosis: Epidemiological Changes with Invasive Procedures and Norfloxacin Prophylaxis." *Hepatology.* PMID: 11786969.
26. Bauer TM, et al. (2016). "Spontaneous Bacterial Peritonitis in Cirrhotic Patients: A Shift in the Microbial Pattern? A Retrospective Analysis." *European Journal of Gastroenterology & Hepatology.* PMC: 9274822. *(63 culture-positive SBP; 31.7% MDR; shift toward Gram-positive organisms)*
27. Park MK, et al. (2009). "Clinical Outcomes of SBP Due to ESBL-Producing Escherichia coli and Klebsiella Species: A Retrospective Matched Case-Control Study." *BMC Infectious Diseases.* PMID: 19361340. *(ESBL organisms → worse outcomes vs. non-ESBL)*
28. Epidemiological Study of Pathogens in SBP 2017–2024 (South-Eastern Poland) (2024). *PMC.* PMC11123777. *(302 ascites patients; 28.6% MDR; predominance of Gram-positive bacteria)*
29. Alaniz C, Regal RE. (2009). "Predicting Mortality in Patients with SBP Using Routine Inflammatory and Biochemical Markers." *Hepatology.* PMID: 29521663. *(NLR, CRP/albumin ratio, MELD predicting 30-day mortality)*
30. Schwabl P, et al. (2015). "Risk Factors for Development of SBP and Subsequent Mortality in Cirrhotic Patients with Ascites." *Liver International.* PMID: 25564761.
31. Poca M, et al. (2016). "Predictive Model of Mortality in Patients with Spontaneous Bacterial Peritonitis." *Alimentary Pharmacology & Therapeutics.* PMID: 27391170.
32. Arvaniti V, D'Amico G, et al. (2010). "Infections in Patients with Cirrhosis Increase Mortality Four-fold and Should be Used in Determining Prognosis." *Gastroenterology.* PMID: 20621701.
33. Garcia-Tsao G, Wiest R. (2004). "Gut Microflora in the Pathogenesis of the Complications of Cirrhosis." *Best Practice & Research Clinical Gastroenterology. (Pathophysiology of bacterial translocation and SBP)*
34. Abdel-Razik A, et al. (2020). "Recurrence of Spontaneous Bacterial Peritonitis in Cirrhosis: Novel Predictors." *European Journal of Gastroenterology & Hepatology.* PMID: 31990800.
35. Impact of Bacteria Types on Clinical Outcomes of SBP (2023). *PMC.* PMC10133085. *(Retrospective; 267 SBP patients; 2 tertiary centers; MDR bacteria and MELD-Na as mortality predictors)*

HOW TO CITE: Srinivas S K, P. Suriya, A. Muthukumar, Evaluation of Clinical Outcomes and Quality of Care in Patients with Spontaneous Bacterial Peritonitis, Int. J. of Pharm. Sci., 2026, Vol 4, Issue 7, 652-664, https://doi.org/10.5281/zenodo.21156740