Journal of Cardiovascular Disease Research
ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 04, 2021

An Insight of Spontaneous Bacterial Peritonitis

Mohamed Ahmed Ahmed Abdel wahed [1], Tarik Ibrahim Ali Zaher [2], Ahmed Mokhtar Ahmed Ebrahim [3], Ahmed Abou El khair Ahmed Badawy [2]
1 Police Academy Hospitals, Cairo, Egypt
2 Tropical Medicine and 3 Clinical Pathology Departments, Faculty of Medicine, Zagazig University, Egypt.
Corresponding Author: Mohamed Ahmed Ahmed Abdel wahed
Email: mohamedabwahed90@gmail.com

Abstract

Background: Liver cirrhosis represents a terminal clinical stage of chronic liver disease. Patients with liver cirrhosis are susceptible to a variety of complications. Ascites or accumulation of fluid within the peritoneal cavity is one of the most common complications. Spontaneous bacterial peritonitis (SBP) is the infection of pre-existing ascitic fluid without evidence of a secondary infection. The diagnosis of SBP is based on a polymorphonuclear leukocyte (PMN) count in ascitic fluid of ≥250 cells/mm3, irrespective of whether the ascitic fluid indicates positive results on bacterial culture. After transporting the ascitic fluid to the laboratory, the number of PMNs in this fluid is measured. False-negative results may occur due to lysis of the PMNs during transport to the laboratory. Manual counting of the PMN in the ascitic fluid is operator-dependent and can delay the diagnosis. SBP leads to hospitalization of 10–30% of cirrhotic patients, and the mortality rate in this group approaches 30%. Owing to the high mortality rate, patients with SBP should be started on empiric, broad-spectrum antibiotics immediately. According to the 2012 American Association for the Study of Liver Disease guidelines, in patients with suspected SBP, empiric therapy should be initiated promptly to maximize patient survival.

Keywords: Spontaneous Bacterial Peritonitis

Background

Spontaneous bacterial peritonitis (SBP) is an acute bacterial infection of ascitic fluid. Generally, no source of the infecting agent is easily identifiable **(1)**.

Spontaneous bacterial peritonitis occurs in both children and adults and is a well-known and ominous complication in patients with cirrhosis. Of patients with cirrhosis who have spontaneous bacterial peritonitis, 70% are Child-Pugh class C. In these patients, the development of spontaneous bacterial peritonitis is associated with a poor long-term

ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 04, 2021

prognosis. Patients with cirrhosis who develop spontaneous bacterial peritonitis in the face of septic shock are at high risk of mortality **(2)**.

Once thought to occur only in those individuals with alcoholic cirrhosis, spontaneous bacterial peritonitis is now known to affect patients with cirrhosis from any cause. In addition, spontaneous bacterial peritonitis can occur as a complication of any disease state that produces the clinical syndrome of ascites, such as heart failure and Budd-Chiari syndrome. Children with nephrosis or systemic lupus erythematosus who have ascites have a high risk of developing spontaneous bacterial peritonitis **(3)**.

SBP is observed in 15-26% of patients hospitalized with ascites. The syndrome arises most commonly in patients whose low-protein ascites (< 1 g/dL) contains low levels of complement, resulting in decreased opsonic activity. SBP appears to be caused by the translocation of gastrointestinal (GI) tract bacteria across the gut wall and also by the hematogenous spread of bacteria. The most common causative organisms are *Escherichia coli, Streptococcus pneumoniae, Klebsiella* species, and other gram-negative enteric organisms **(4)**.

Epidemiology

In patients with ascites, the frequency may be as high as 18%. This number has grown from 8% over the past 2 decades, most likely secondary to an increased awareness of spontaneous bacterial peritonitis and a lowered threshold to perform diagnostic paracentesis **(5)**.

No race predilection is known for spontaneous bacterial peritonitis. In patients with ascites, both sexes are affected equally **(6).**

Although the etiology and incidence of hepatic failure differ between children and adults, in those individuals with ascites, the incidence of spontaneous bacterial peritonitis is roughly equal. Two peak ages for spontaneous bacterial peritonitis are characteristic in children: the first in the neonatal period and the second at age 5 years **(5)**.

According to a 2015 study by Ge and Runyon, when the initial infection was spontaneous bacterial peritonitis, subsequent infections were more likely to be caused by drug-resistant organisms. The risk of subsequent infections was increased in older patients and in patients taking proton-pump-inhibitors (PPIs) or spontaneous bacterial peritonitis prophylaxis (i.e., selective intestinal decontamination) **(7).**

Pathophysiology:

The mechanism for bacterial inoculation of ascites has been the subject of much debate since Harold Conn first recognized the disorder in the 1960s. Enteric organisms have traditionally been isolated from more than 90% of infected ascites fluid in spontaneous

bacterial peritonitis, suggesting that the GI tract is the source of bacterial contamination **(8)**.

The preponderance of enteric organisms, in combination with the presence of endotoxin in ascitic fluid and blood, once favored the argument that spontaneous bacterial peritonitis was due to direct transmural migration of bacteria from an intestinal or hollow organ lumen, a phenomenon called bacterial translocation. Experimental evidence suggests that direct transmural migration of microorganisms might not be the cause **(9)**.

Etiology

Traditionally, three fourths of spontaneous bacterial peritonitis infections have been caused by aerobic gram-negative organisms (50% of these being *Escherichia coli*). The remainder has been due to aerobic gram-positive organisms (19% streptococcal species) **(9)**.

Some data, however, suggest that the percentage of gram-positive infections may be increasing. One study cites a 34.2% incidence of streptococci, ranking in second position after Enterobacteriaceae. *Viridans* group streptococci (VBS) accounted for 73.8% of these streptococcal isolates **(10,11)**.

Risk factors

Patients with cirrhosis who are in a decompensated state are at the highest risk of developing spontaneous bacterial peritonitis **(3)**. Bacterial translocation (viable microorganism passage from the intestinal lumen to mesenteric lymph nodes) is a key factor in the development of spontaneous bacterial peritonitis. Low complement levels are associated with the development of spontaneous bacterial peritonitis. Patients at greatest risk for spontaneous bacterial peritonitis have decreased hepatic synthetic function with associated low total protein level or prolonged prothrombin time (PT) **(12).**

Patients with low protein levels in ascitic fluid (< 1 g/dL) have a 10-fold higher risk of developing spontaneous bacterial peritonitis than those with a protein level greater than 1 g/dL **(3)**.

Prognosis

The mortality rate in patients with spontaneous bacterial peritonitis ranges from 40-70% in adult patients with cirrhosis. Rates are lower in children with nephrosis. Patients with concurrent renal insufficiency are at higher risk for mortality from spontaneous bacterial peritonitis than those without concurrent renal insufficiency. Mortality from spontaneous bacterial peritonitis may be decreasing among all subgroups of patients because of advances in its diagnosis and treatment. In addition, nonselective beta-blockers increase the risk for hepatorenal syndrome and death in patients with cirrhosis and spontaneous bacterial peritonitis ***(13)***.

Growing evidence supports early diagnostic paracentesis (defined as occurring within the first 11 hours of presentation). This, combined with early antibiotic treatment, leads to

decreased ICU and hospital length of stay, in-hospital mortality, and 3-month mortality **(14)**.

Diagnosis:

A broad range of signs and symptoms are seen in spontaneous bacterial peritonitis (SBP). A high index of suspicion must be maintained when caring for patients with ascites, particularly those with acute clinical deterioration. Completely asymptomatic cases have been reported in as many as 30% of patients **(5)**.

Signs and Symptoms:

Fever and chills occur in as many as 80% of patients. Abdominal pain or discomfort is found in as many as 70% of patients.

Other signs and symptoms may include the following **(8)**. Worsening or unexplained encephalopathy.

- Diarrhea.
- Ascites that does not improve following administration of diuretic medication.
- Worsening or new-onset renal failure.
- Ileus.

Work up:

All patients suspected of having spontaneous bacterial peritonitis (SBP) must undergo peritoneal fluid analysis while in the emergency department. Diagnostic paracentesis should be performed in all patients who do not have an indwelling peritoneal catheter and are suspected of having spontaneous bacterial peritonitis. In peritoneal dialysis patients with a peritoneal catheter, fluid should be withdrawn with sterile technique. Ultrasonography may aid paracentesis if ascites is minimally detectable or questionable. Growing evidence supports early diagnostic paracentesis (defined as occurring within the first 11 hours of presentation). This, combined with early antibiotic treatment, leads to decreased ICU and hospital length of stay, in-hospital mortality, and 3-month mortality **(14)**.

Blood and urine cultures should be obtained in all patients suspected of having spontaneous bacterial peritonitis. Blood culture results are positive for the offending agent in as many as 33% of patients with spontaneous bacterial peritonitis and may help guide antibiotic therapy. Urine culture may also prove useful, since asymptomatic bacteruria has been suggested to predispose to the development of spontaneous bacterial peritonitis **(5)**.

Peritoneal Fluid Analysis

Peritoneal fluid analysis must be performed in any patient in whom spontaneous bacterial peritonitis (SBP) is considered. In patients undergoing peritoneal dialysis (PD), this can be

accomplished by obtaining a sample of the dialysate. In patients without a peritoneal catheter, diagnostic paracentesis must be performed **(8)**.

The examination of ascitic fluid for SBP has routinely involved sending the fluid for cell count, differential, and culture. It has been accepted that the results of aerobic and anaerobic bacterial cultures, used in conjunction with the cell count, are beneficial in guiding therapy for those with SBP **(15)**.

Ascitic fluid neutrophil count

An ascitic fluid neutrophil count of more than 500 cells/µL is the single best predictor of spontaneous bacterial peritonitis, with a sensitivity of 86% and specificity of 98%. Lowering the ascitic fluid neutrophil count to more than 250 cells/µL results in an increased sensitivity of 93% but a lower specificity of 94%. (For simplicity, a threshold of 250 cells/µL is used for the remainder of this discussion **(8, 16)**.

Ascitic Calprotectin

Ascitic calprotectin is a biomarker that is gaining traction and interest for use in earlier detection and more expedient treatment. It has been shown to reliably predict PMN count > 250/uL, which may prove useful in diagnosis of SBP **(17)**.

Other studies of ascitic fluid to be considered include the following:

- Cytology
- Lactate level
- pH

An ascites lactate level of more than 25 mg/dL was found to be 100% sensitive and specific in predicting active spontaneous bacterial peritonitis in a retrospective analysis. In the same study, the combination of an ascites fluid pH below 7.35 and polymorphonuclear neutrophil count above 500 cells/µL was 100% sensitive and 96% specific for spontaneous bacterial peritonitis **(8)**.

A 2012 study investigated using leukocyte reagent strips in the emergency department as a means of expediting the diagnosis of spontaneous bacterial peritonitis **(18)**. In this prospective study, 223 patients presenting with ascites and who had paracentesis performed in the emergency department had their peritoneal fluid sent for the usual diagnostic tests, but they also had the fluid dipped with both a Uri-Quick Clini 10 strip and Multistix 10SGA. Both had at least 90% positive predictive value and 94% negative predictive value for spontaneous bacterial peritonitis when compared with the criterion standard of peritoneal fluid Gram stain and culture—thus allowing a shorter interval between diagnosis and initiation of treatment **(5)**.

Combined ascitic fluid neutrophil count and culture:

Combining the results of the ascitic fluid polymorphonuclear neutrophil (PMN) count and the ascitic fluid culture yields the following subgroups **(8)**.

- Spontaneous bacterial peritonitis
- Culture-negative neutrocytic ascites (probable spontaneous bacterial peritonitis)
- Monomicrobial non-neutrocytic bacterascites

Spontaneous bacterial peritonitis is noted when the PMN count is 250 cells/µL or higher, in conjunction with a positive bacterial culture result. As mentioned previously, one organism is usually identified on the culture in most cases. Obviously, these patients should receive antibiotic therapy **(5)**.

Culture-negative neutrocytic ascites (probable spontaneous bacterial peritonitis) is noted when the ascitic fluid culture results are negative, but the PMN count is 250 cells/µL or higher. This may happen in as many as 50% of patients with SBP and may not actually represent a distinctly different disease entity. It may be the result of poor culturing techniques or late-stage resolving infection. Nonetheless, these patients should be treated just as aggressively as those with positive culture results **(9)**.

Monomicrobial non-neutrocytic bacterascites exists when a positive culture result coexists with a PMN count of 250 cells/µL or fewer. Although this may often be the result of contamination of bacterial cultures, one study found that 38% of these patients subsequently develop spontaneous bacterial peritonitis. Therefore, monomicrobial non-neutrocytic bacterascites may represent an early form of spontaneous bacterial peritonitis **(8)**.

All study patients described that eventually developed spontaneous bacterial peritonitis were symptomatic. For this reason, any patient suspected clinically of having spontaneous bacterial peritonitis in this setting must be treated **(9)**.

References.

1. **Kim JJ, Tsukamoto MM, Mathur AK, Ghomri YM, Hou LA, Sheibani S, et al.** Delayed paracentesis is associated with increased in-hospital mortality in patients with spontaneous bacterial peritonitis. Am J Gastroenterol. 2014; 109 (9):1436-42.

2. **Lata J, Stiburek O, Kopacova M.** Spontaneous bacterial peritonitis: a severe complication of liver cirrhosis. World J Gastroenterol. 2009; 15 (44):5505-10.

3. **Runyon BA.** Introduction to the revised American Association for the Study of Liver Diseases Practice Guideline management of adult patients with ascites due to cirrhosis 2012. Hepatology, 2013; 57: 1651-1653.

4. **Komolafe O, Roberts D, Freeman SC, et al.** Antibiotic prophylaxis to prevent spontaneous bacterial peritonitis in people with liver cirrhosis: a network meta-analysis. Cochrane Database Syst Rev. 2020; 1(1): CD013125.

5. **Li YT, Huang JR, Peng ML.** Current Status and Prospects of Spontaneous Peritonitis in Patients with Cirrhosis. Biomed Res Int. 2020; 2020:3743962.

6. **Mazer L, Tapper EB, Piatkowski G, Lai M.** The need for antibiotic stewardship and treatment standardization in the care of cirrhotic patients with spontaneous bacterial peritonitis - a retrospective cohort study examining the effect of ceftriaxone dosing. F1000Res. 2014; 3: 57.

7. **Ge PS, Runyon BA.** Preventing future infections in cirrhosis: a battle cry for stewardship. Clin Gastroenterol Hepatol. 2015; 13 (4):760-2.

8. **Duah A, Nkrumah KN.** Spontaneous bacterial peritonitis among adult patients with ascites attending Korle-Bu Teaching Hospital. Ghana Med J. 2019; 53(1): 37-43.

9. **Iogna Prat L, Wilson P, Freeman SC, et al.** Antibiotic treatment for spontaneous bacterial peritonitis in people with decompensated liver cirrhosis: a network meta-analysis. Cochrane Database Syst Rev. 2019; 9(9): CD013120.

10. **Bert F, Noussair L, Lambert-Zechovsky N, Valla D.** Viridans group streptococci: an underestimated cause of spontaneous bacterial peritonitis in cirrhotic patients with ascites. Eur J Gastroenterol Hepatol. 2005; 17(9):929-33.

11. **Cholongitas E, Papatheodoridis GV, Lahanas A, Xanthaki A, Kontou-Kastellanou C, Archimandritis AJ.** Increasing frequency of Gram-positive bacteria in spontaneous bacterial peritonitis. Liver Int. 2005; 25(1):57-61.

12. **Sundaram V, Manne V, Al-Osaimi AM.** Ascites and spontaneous bacterial peritonitis: recommendations from two United States centers. Saudi J Gastroenterol. 2014; 20(5): 279-287.

13. **Mandorfer M, Bota S, Schwabl P, Bucsics T, Pfisterer N, Kruzik M.** Nonselective ß blockers increase risk for hepatorenal syndrome and death in patients with cirrhosis and spontaneous bacterial peritonitis. Gastroenterology. 2014; 146(7):1680-90.e1.

14. **Orman ES, Hayashi PH, Bataller R, Barritt AS 4th.** Paracentesis is associated with reduced mortality in patients hospitalized with cirrhosis and ascites. Clin Gastroenterol Hepatol. 2014; 12(3): 496-503.e1.

15. **Riggio O, Angeloni S.** Ascitic fluid analysis for diagnosis and monitoring of spontaneous bacterial peritonitis. World J Gastroenterol. 2009; 15(31): 3845–3850.

16. **Gaya DR, David B Lyon T, et al.** Bedside leucocyte esterase reagent strips with spectrophotometric analysis to rapidly exclude spontaneous bacterial peritonitis: a pilot study. Eur J Gastroenterol Hepatol. 2007; 19(4):289-95.

17. **Burri E, Schulte F, Muser J, Meier R, Beglinger C.** Measurement of calprotectin in ascitic fluid to identify elevated polymorphonuclear cell count. World J Gastroenterol. 2013; 19(13):2028-36.

18. **Téllez-Ávila FI, Chávez-Tapia NC, Franco-Guzmán AM, Uribe M, Vargas-Vorackova F.** Rapid diagnosis of spontaneous bacterial peritonitis using leukocyte esterase reagent strips in emergency department: uri-quick clini-10SG® vs. Multistix 10SG®. Ann Hepatol. 2012; 11(5):696-9.