Physician Clinical Impression Does Not Rule Out Spontaneous Bacterial Peritonitis in Patients Undergoing Emergency Department Paracentesis

Brian Chinnock, MD
Hagop Afarian, MD
Hal Minnigan, MD
Jack Butler, MD
Gregory W. Hendey, MD

From the Department of Emergency Medicine, UCSF–Fresno Medical Education Program, Fresno, CA (Chinnock, Afarian, Hendey); the Department of Emergency Medicine, Indiana University School of Medicine, Indianapolis, IN (Minnigan); and the Department of Emergency Medicine, Texas Tech University Health Sciences, Center–El Paso, El Paso, TX (Butler).

Study objective: We determine whether clinical characteristics and physician assessment are useful in the exclusion of spontaneous bacterial peritonitis in emergency department (ED) patients with ascites requiring paracentesis.

Methods: We conducted a prospective, observational study of ED patients with ascites undergoing paracentesis. Predefined clinical characteristics including historical features and ED vital signs were recorded. Each patient was assessed by 2 separate, blinded physicians for severity of abdominal tenderness and overall clinical suspicion for spontaneous bacterial peritonitis. The primary outcome measures were sensitivity, specificity, and likelihood ratios (LR) of the individual clinical characteristics and the physician assessments. Spontaneous bacterial peritonitis was defined by absolute neutrophil count greater than 250 cells/mm^3 or positive fluid culture result.

Results: There were 285 separate physician assessments in 144 patients enrolled with complete data. Spontaneous bacterial peritonitis was diagnosed in 17 (11.8%) patients. Physician clinical impression had a sensitivity of 76% (95% confidence interval [CI] 62% to 91%) and specificity of 34% (95% CI 28% to 40%) for the detection of spontaneous bacterial peritonitis. The lowest negative LR was associated with the presence of any abdominal pain or tenderness (negative LR=0.4); however, the presence of pain/tenderness was also observed in 85% of patients without spontaneous bacterial peritonitis. Six patients (4.2%) with spontaneous bacterial peritonitis had at least 1 physician assessment of little to no risk for spontaneous bacterial peritonitis, and 3 of the 6 subsequently died during their hospitalization.

Conclusion: Clinical characteristics and physician assessment were insufficient in the diagnosis or exclusion of spontaneous bacterial peritonitis in the ED patient undergoing diagnostic or therapeutic paracentesis. This finding supports routine laboratory fluid analysis after ED paracentesis. [Ann Emerg Med. 2008;52:268-273.]

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INTRODUCTION

Diagnostic paracentesis is an important emergency department (ED) procedure in evaluating for spontaneous bacterial peritonitis in the patient with ascites. In addition, therapeutic paracentesis is a mainstay of treatment for ameliorating the discomfort associated with large-volume ascites. Although many patients have their therapeutic paracentesis performed in a scheduled outpatient clinic setting, an increasingly large number of patients without access to primary or specialty care are coming to the ED for therapeutic paracentesis. In the outpatient clinic ED setting, 2 studies examining asymptomatic patients presenting for a therapeutic paracentesis showed a combined 2.5% incidence of spontaneous bacterial peritonitis (defined as absolute neutrophil count >250 cells/mm^3) in 545 patients.[1,2] This low incidence of spontaneous bacterial peritonitis in the outpatient setting contrasts with that observed in the hospitalized patient. Studies have demonstrated a 12% incidence of spontaneous bacterial

Editor's Capsule Summary

What is already known on this topic

Spontaneous bacterial peritonitis in outpatients having therapeutic paracentesis for symptomatic ascites is unusual, but the incidence in emergency department (ED) patients and the ability to detect it by clinical methods alone are little studied.

What question this study addressed

Is physician clinical assessment of likelihood of spontaneous bacterial peritonitis highly sensitive for the detection of spontaneous bacterial peritonitis, and can it alone reliably rule out spontaneous bacterial peritonitis in the ED ascites patient?

What this study adds to our knowledge

Among 144 patients having ED paracentesis, 12% had spontaneous bacterial peritonitis, a rate similar to that of inpatients. Physicians performed poorly at predicting which patients had spontaneous bacterial peritonitis, and no pattern of clinical features could identify patients with no risk of spontaneous bacterial peritonitis.

How this might change clinical practice

Peritoneal fluid analysis should be done routinely after all ED paracentesis because detection of spontaneous bacterial peritonitis by clinical means is poor and the incidence is significant.

peritonitis in patients admitted with decompensated cirrhosis and an 18% incidence in patients admitted with hepatic encephalopathy.[3,4] It is unknown where the ED patient presenting for paracentesis fits in this spectrum; therefore, the role of routine ascites fluid analysis for spontaneous bacterial peritonitis in the ED patient is less clear. Because mortality is 20% even in treated spontaneous bacterial peritonitis patients, it is important not to miss the diagnosis.[5] To our knowledge, no studies exist that examine which patients who present to the ED might be safe candidates for therapeutic paracentesis without ascites fluid analysis. The aim of this study, therefore, is to prospectively determine whether patient clinical characteristics or physician assessment of likelihood of spontaneous bacterial peritonitis is highly sensitive for the detection of spontaneous bacterial peritonitis and thus could reliably rule out spontaneous bacterial peritonitis in the ascites patient.

MATERIALS AND METHODS

Study Design

This was a prospective, observational study done to assess the ability of patient clinical characteristics and physician clinical impression to rule out spontaneous bacterial peritonitis in ED ascites patients. A convenience sample of patients was enrolled 24 hours a day during all days of the week. The study was approved by the institutional review board at each facility.

Study Setting and Population

The 3 participating EDs had a combined census of 220,000 patients per year. All 3 EDs have emergency medicine residencies (two 3-year programs and one 4-year) in which resident cases are staffed by board-certified emergency physicians. The EDs are located in urban areas serving a largely underserved patient population and have no specialized hepatology services. Patients were enrolled between April 2005 and August 2006.

Ascites patients who the physician believed should undergo paracentesis and fluid analysis were enrolled in the study. On initial evaluation of the patient, a data form was filled out by the enrolling physician, which was separated into 2 sections: patient clinical characteristics and physician clinical impression. The following patient clinical characteristics were collected at the initial patient encounter: (1) symptoms within 24 hours of ED visit: fever (tactile or measured >38°C), nausea or vomiting, hematochezia, melena, or hematemesis; (2) ED vital signs: highest pulse, highest temperature, lowest temperature, lowest systolic blood pressure; (3) ED physical examination: altered mental status. Physician clinical impression data were then completed: assessment of the patient's abdominal pain as (1) no abdominal pain, (2) "pain/tenderness is mild and due to distention alone," or (3) "pain/tenderness is more severe, concerning for spontaneous bacterial peritonitis." Also, spontaneous bacterial peritonitis likelihood was assessed as (1) "not worried about spontaneous bacterial peritonitis (only therapeutic paracentesis required)," (2) "must do fluid analysis to rule out spontaneous bacterial peritonitis (diagnostic paracentesis only)," or (3) "must do fluid analysis to rule out spontaneous bacterial peritonitis (therapeutic and diagnostic paracentesis required)." New-onset ascites patients were noted and all considered to need diagnostic paracentesis.

After the initial assessment, a second physician performed an independent evaluation. The second physician was provided a copy of the patient clinical information (symptoms, vital signs, etc) but was not given the part of the data form containing the first physician's clinical impression of abdominal pain or spontaneous bacterial peritonitis likelihood. Both physicians had access to all available clinical information, including laboratory results, but were not permitted to discuss the case until the paperwork was completed. Enrolling physicians were required to be at or above the post-graduate year (PGY) 2 level.

Outcome Measures

Spontaneous bacterial peritonitis was defined as either a peritoneal fluid absolute neutrophil count greater than 250 cells/mm^3 or growth of a pathogenic bacterium on fluid culture. In the case of a traumatic paracentesis, 1 absolute neutrophil count was subtracted for every 250 RBCs in the ascitic fluid.[6] The primary outcome measures were the test characteristics of the individual patient clinical characteristics and physician clinical assessment of abdominal pain and spontaneous bacterial peritonitis likelihood. For physician clinical assessment of spontaneous bacterial peritonitis likelihood, a false negative was

Table 1. Characteristics of the study population.

Clinical Characteristic	Total (%)	SBP (%)	No SBP (%)	LR+	LR−	Sensitivity	Specificity
Symptoms in last 24 h							
Fever	30/144 (20.8)	6/17 (35.3)	24/127 (18.9)	1.9 (0.9–4.2)	0.8 (0.6–1.1)	35.3 (14.2–61.7)	81.1 (73.2–87.5)
Nausea/vomiting	38/144 (26.4)	5/17 (29.4)	33/128 (25.8)	1.1 (0.5–2.5)	1.0 (0.7–1.3)	29.4 (10.3–56)	74.2 (65.7–81.5)
GI bleeding	16/143 (11.2)	3/17 (17.6)	13/126 (10.3)	1.7 (0.5–5.4)	0.9 (0.7–1.2)	17.7 (3.8–43.4)	89.7 (83–94.4)
Vital signs							
Fever (>38°C [100.4°F])	15/138 (10.9)	3/17 (17.7)	12/121 (9.9)	1.8 (0.6–5.7)	0.9 (0.7–1.2)	17.7 (3.8–43.4)	90.1 (83.3–94.8)
Hypothermia (<36°C [96.8°F])	9/138 (6.5)	1/17 (5.9)	8/121 (6.6)	0.9 (0.1–6.7)	1.0 (0.9–1.2)	5.9 (0.2–28.7)	93.4 (89.0–97.8)
Tachycardia (HR ≥100)	72/137 (52.6)	9/16 (56.3)	63/121 (52.1)	1.1 (0.7–1.7)	0.9 (0.5–1.6)	56.3 (29.9–80.3)	47.9 (38.8–57.2)
Hypotension (systolic <90 mm Hg)	9/138 (6.5)	1/17 (5.9)	8/121 (6.6)	0.9 (0.1–6.7)	1.0 (0.9–1.2)	5.9 (0.15–28.7)	93.4 (89.0–97.8)
Physical examination							
Altered mental status	8/144 (5.6)	2/17 (11.8)	6/127 (4.7)	2.5 (0.6–11.4)	0.9 (0.8–1.1)	11.8 (1.5–36.4)	95.3 (90–98.3)
No abdominal pain or tenderness	20/143 (14)	1/17 (5.9)	19/126 (15.1)	0.4 (0.1–2.7)	1.1 (1.0–1.3)	5.9 (0–17.1)	85.0 (78.7–91.2)
Mild abdominal pain or tenderness	87/143 (60.8)	9/17 (52.9)	78/126 (61.9)	0.9 (0.5–1.4)	1.2 (0.7–2.1)	52.9 (29.2–76.7)	38.1 (29.6–46.6)
Severe abdominal pain or tenderness	36/143 (25.2)	7/17 (41.2)	29/126 (23.0)	1.8 (0.9–3.4)	0.8 (0.5–1.2)	41.2 (17.8–64.6)	77 (69.7–84.3)
Any abdominal pain or tenderness	123/143 (86.0)	16/17 (94.1)	107/126 (85)	1.1 (1.0–1.3)	0.4 (0.1–2.7)	94.1 (82.9–100)	15.1 (8.8–21.3)

SBP, Spontaneous bacterial peritonitis; *GI,* gastrointestinal; *HR,* pulse rate; *mmHg,* millimeters mercury.
Numbers and percentages are reported for patients with and without SBP, as well as positive and negative LR, sensitivities, and specificities given with 95% CIs in parentheses. Demographics: Mean age: 50.3 years (range 23 to 79 years); male: 68%; antibiotics in last week: 13 (9.1%); total cases of SBP: 17 (11.8%).

considered to be a physician assessment of no or low likelihood for spontaneous bacterial peritonitis ("therapeutic-only" paracentesis), with a final diagnosis of spontaneous bacterial peritonitis. In case of discordant physician impressions, the more experienced physician's evaluation was used.

We calculated interrater agreement of physicians' clinical impression of spontaneous bacterial peritonitis likelihood, and we evaluated the effect of physician experience by comparing faculty and residents in their clinical impression for spontaneous bacterial peritonitis.

Primary Data Analysis

Likelihood ratios (LRs), sensitivity, and specificity were calculated with 95% confidence intervals (CIs), using calculators at http://statpages.orgconfint.html.

RESULTS

Among the 3 participating hospitals 155 patients with ascites were enrolled in our study. Eleven patients had paracentesis performed but no laboratory fluid analysis and were excluded, leaving 144 patients with complete absolute neutrophil count data. There were 285 assessments by 106 physicians. There were 65 PGY-2, 60 PGY-3, 18 PGY-4, and 142 faculty physician assessments. Seventeen patients (11.8%) met absolute neutrophil count or culture criteria for spontaneous bacterial peritonitis.

Characteristics of the study group are summarized in Table 1. All of these characteristics had similar frequencies in patients with or without spontaneous bacterial peritonitis. None had a negative LR low enough to reliably rule out spontaneous bacterial peritonitis or a positive LR sufficiently high to rule in spontaneous bacterial peritonitis. The only characteristic with a positive LR greater than 2.0 was "altered mental status."

There were 285 clinical impressions collected for 144 patients. The physician thought that a diagnostic paracentesis was indicated in 189 (66%), whereas only a therapeutic paracentesis was needed in 96 (34%). Physician ability to detect spontaneous bacterial peritonitis was poor, with a sensitivity of 76.5% (95% CI 62.2% to 90.7%) and specificity of 34.3% (95% CI 29.2% to 41.3%). The interrater agreement of the need for diagnostic paracentesis was 78.6%. In the comparison of faculty to resident clinical impression of spontaneous bacterial peritonitis, we found a trend in favor of faculty physicians (Table 2).

Overall, there were 8 assessments of 6 patients eventually diagnosed with spontaneous bacterial peritonitis in which the physician believed the patient did not require a diagnostic tap. The items marked by an asterick in Table 3 highlight positive findings that may indicate spontaneous bacterial peritonitis; however, there are no visible trends or similarities between these patients to help reveal why they were missed. In 4 of the 6 patients, there were discordant physician assessments, with one physician indicating the need for fluid analysis and the other physician indicating no need. In the other 2 patients, both physicians agreed that the patient did not need a diagnostic tap. Patient 5 had no clinical indicators of illness, other than mild abdominal pain. Because of his benign appearance, he was considered stable for outpatient treatment and was treated with

Table 2. Sensitivity and specificity of physician clinical impression for spontaneous bacterial peritonitis.

		Final Diagnosis	
Physician Impression	**Diagnostic Tap Needed**	**SBP**	**No SBP**
All physicians	Yes	26	165
	No	8	86
		Sens: 76.5% (62.2%–90.7%)	Spec: 34.3% (28.4%–40.1%)
Faculty	Yes	14	84
	No	2	42
		Sens: 87.5% (71.3%–100%)	Spec: 33.3% (25.1%–41.6%)
Resident	Yes	12	81
	No	6	44
		Sens: 66.7% (44.9%–88.4%)	Spec: 35.2% (26.8%–43.6%)

These 3 2×2 tables are for overall impression with 285 total patient assessments, faculty assessments alone, and resident assessments alone. Interrater agreement between paired physician assessments for each patient is listed; 95% CIs given in parentheses.

Table 3. Characteristics of patients with spontaneous bacterial peritonitis who were not thought to require a diagnostic paracentesis.

Characteristics	**Patient 1**	**Patient 2**	**Patient 3**	**Patient 4**	**Patient 5**	**Patient 6**
ANC (cells/mm^3)	3,256*	657*	361*	1,705*	402*	2.8
Culture growth	None	Klebsiella*	None	None	None	MRSA*
Vital signs						
Febrile	No	No	No	No	No	No
Tachycardic	No	No	Yes*	Yes*	No	Yes*
Hypotensive	No	No	No	No	No	No
Physical examination						
Altered mental status	No	Yes*	No	No	No	No
Abdominal pain or tenderness to palpation	None	Mild	Mild	None	Mild	Mild
Signs/symptoms in last 24 h						
Fever	Yes*	No	No	No	No	No
Nausea/vomiting	No	Yes*	Yes*	No	No	Yes*
GI bleeding	No	No	No	No	No	No

ANC, Absolute neutrophil count.
*Indicates positive characteristics.

levofloxacin. He was treated on 2 subsequent visits for "fatigue and weakness" during the next 4 days and discharged home. Three days later, he became obtunded, was hospitalized, and died. Peritoneal fluid analysis during this hospitalization revealed spontaneous bacterial peritonitis, with an absolute neutrophil count of 1,560 cells/mm^3. Patient 4 presented with worsening ascites, was admitted for spontaneous bacterial peritonitis, and was discharged 4 days later but was assessed as low likelihood for spontaneous bacterial peritonitis by both physicians in the ED. Patient 6 had a normal absolute neutrophil count but growth of methicillin-resistant *Staphylococcus aureus*. He was discharged from the ED without antibiotics, and follow-up information was not available. Three of the 6 patients died during their hospitalization.

LIMITATIONS

Our study is limited by its small number of patients with spontaneous bacterial peritonitis. In addition, determination of physician clinical impression for spontaneous bacterial peritonitis was made before paracentesis was performed. Therefore, ascitic fluid appearance was not used in clinician decisionmaking and might have affected the clinical impression. One retrospective study demonstrated that 98% of patients with spontaneous bacterial peritonitis had peritoneal fluid appearance described as "hazy," "cloudy," or "bloody," making "clear" fluid a potentially useful marker in ruling out spontaneous bacterial peritonitis. However, "hazy" was also the most common appearance of fluid in patients without spontaneous bacterial peritonitis.[7] In our study, in the 6 patients with spontaneous bacterial peritonitis who the physician thought did not have need of a diagnostic tap, the laboratory technician assessment of fluid appearance was "hazy" in 3 patients, "bloody" in 1 patient, "clear" in 1 patient, and "cloudy" in 1 patient.

Vital sign determinations were recorded on the forms only up to the point that paracentesis occurred. If a patient developed fever, tachycardia, or hypotension later in the evaluation, it would likely have a profound effect on clinician suspicion for spontaneous bacterial peritonitis. Also, serum laboratory values were not available to the physician at enrollment for many of the patients in this study. The presence of a high WBC count or a significant deterioration in renal function might have significantly affected physician impression.

The patients in this study constitute a heterogeneous group of ascites patients, and clinical criteria might work better for

some subgroups than others. Finally, limiting enrollment to those patients who the physician thought required fluid analysis may have created a bias toward those who were more likely to have spontaneous bacterial peritonitis.

DISCUSSION

In our study, clinical signs, symptoms, and physician impression were poor in ruling out spontaneous bacterial peritonitis. Some degree of abdominal pain was present in nearly all patients with or without spontaneous bacterial peritonitis, whereas fever was uncommon even in those with disease. Other retrospective studies of inpatients have demonstrated poor performance of clinical signs in the diagnosis of spontaneous bacterial peritonitis. Fever, abdominal pain, and encephalopathy were present in 32% to 54%, 41% to 57%, and 9% to 74% of spontaneous bacterial peritonitis patients, respectively.[8-10] Although abdominal pain or tenderness was present in 94% of the patients with spontaneous bacterial peritonitis in our study, it was also present in 85% of patients without spontaneous bacterial peritonitis, making it an unreliable differentiating clinical sign. This demonstrates that the pain related to the abdominal wall distention of large-volume ascites in the non–spontaneous bacterial peritonitis patient may be difficult to differentiate from peritoneal irritation in the spontaneous bacterial peritonitis patient.

The more experienced faculty physicians had higher sensitivity at detecting spontaneous bacterial peritonitis compared with resident physicians. Although this may be an intuitive finding, even faculty physicians had inadequate sensitivity to reliably rule out spontaneous bacterial peritonitis without fluid analysis.

Most of our patients demonstrated the variant of spontaneous bacterial peritonitis known as culture-negative neutrocytic ascites, in which the absolute neutrophil count is greater than 250 cells/mm^3, with no culture growth. Another variant, known as "bacterascites," is diagnosed when the culture result is positive despite an absolute neutrophil count less than 250 cells/mm^3. It is unclear whether bacterascites represents true pathogenic growth or simple transient colonization of peritoneal fluid with intestinal flora. Studies have shown similar inhospital mortality in patients with normal ascitic fluid and those with asymptomatic bacterascites, and consensus recommendations do not indicate the need for immediate antimicrobial treatment of these patients.[6,11] However, another study demonstrated that about one third of bacterascites cases progressed to spontaneous bacterial peritonitis.[12] This may have affected our results because one of our patients (Table 3, patient 6) with bacterascites was diagnosed as a "missed spontaneous bacterial peritonitis." However, even if this patient were not considered a "missed spontaneous bacterial peritonitis," it would not markedly change our results.

The rate of spontaneous bacterial peritonitis in patients presenting to outpatient centers for paracentesis is low, obviating the need for routine fluid analyses in these patients.[1,2] Similarly, it is likely that some emergency physicians perform therapeutic paracentesis in the ED without sending the fluid for analysis in patients at low risk for spontaneous bacterial peritonitis. This study does not support that practice pattern and illustrates the potential consequences because 3 of the 6 patients who were thought by at least 1 physician to not need fluid analysis died of sepsis during their subsequent hospitalization.

In summary, physician clinical impression based on patient medical history and physical examination findings demonstrated poor sensitivity in detecting spontaneous bacterial peritonitis. Future prospective studies should examine whether the physician's clinical impression coupled with knowledge of the ascites fluid appearance is adequate to rule out spontaneous bacterial peritonitis without further fluid analysis. Until then, our study suggests that the patient presenting to the ED for paracentesis should undergo routine fluid analysis, even when the clinical suspicion for spontaneous bacterial peritonitis is low.

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Author contributions: BC conceived the study. BC and GWH designed the study. BC, HM, and JB supervised the conduct of the trial and data collection. BC, HA, HM, and JB managed the data. BC and HA did all final data analysis, whereas GWH provided statistical advice. BC and HA drafted the article, and all the authors contributed substantially to its revision. BC takes responsibility for the paper as a whole.

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Address for correspondence: Brian Chinnock, MD, UCSF-Fresno Building, 155 Fresno Street, Suite 216, Fresno, CA 93701; 559-499-6440, fax 559-499-6441; E-mail b.chinnock@comcast.net.

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CORRECTION NOTICE

In the February 2008 issue, in the Images in Emergency Medicine by Hahn, Arnold and Roth ("Painful Facial Rash; page 211), the caption for Figure 1 should have read, "Painful rash in trigeminal nerve distribution."