Does This Patient Have Ascites?

How to Divine Fluid in the Abdomen

John W. Williams, Jr, MD, David L. Simel, MD, MHS

CLINICAL SCENARIOS—DO THESE PATIENTS HAVE ASCITES?

In each of the following cases, the clinician will need to determine whether the patient has ascites. Case 1: A 44-year-old cirrhotic man is admitted with fever but has no obvious source of infection. Case 2: A 57-year-old woman presents with an adnexal mass and recent weight gain but otherwise feels well. Case 3: A 65-year-old man with a history of prior myocardial infarction is admitted for decreased exercise tolerance, increased abdominal girth, and ankle edema.

WHY IS THIS AN IMPORTANT QUESTION TO ANSWER WITH A CLINICAL EXAMINATION?

Free fluid in the abdominal cavity is *ascites*. Ascites is a symptom that may have important diagnostic, prognostic, and therapeutic implications. When clinically detectable, ascites may indicate underlying heart failure, liver disease, nephrotic syndrome, or malignancy. In patients with liver disease, ascites has prognostic significance since operative mortality is increased and overall survival is decreased; ascites may also signal metastases in patients with malignancy.[1] Although patients with small amounts of ascites do not generally require specific therapy, patients with larger amounts of ascites may require intervention to relieve symptoms caused by their distended abdomen. Furthermore, the degree of ascites is useful in monitoring the efficacy of treatment for the underlying condition that caused it (eg, monitoring response to chemotherapy for malignancy).

See also pp 2638 and 2650.

The three clinical scenarios are specific examples of why ascites detection is clinically important. For example, ascites detection in the first patient may lead to the diagnosis of spontaneous bacterial peritonitis as the source of the patient's fever. If ascites is found by clinical examination, the physician may be able to proceed directly to abdominal paracentesis without pausing for imaging procedures. In the second patient, the presence of ascites would heighten the clinician's suspicion of ovarian carcinoma with peritoneal metastasis, implying a more advanced stage and poorer prognosis. In the third patient, the finding of ascites may trigger the physician's consideration of diagnostic possibilities other than severe left-sided congestive heart failure, such as a pericardial effusion causing marked signs of right-sided heart failure. Clearly, clinical determination of the presence or absence of ascites has the advantages of speed, convenience, and cost savings on diagnostic imaging.

It is easy to identify large volumes of ascites clinically, but smaller amounts of ascites are not as obvious. When diagnostic confirmation is necessary, paracentesis is the definitive test, although less invasive radiographic procedures are ordinarily used to corroborate the clinicians' suspicion. Ultrasonography can detect as little as 100 mL of abdominal fluid and is considered the gold standard for diagnosing ascites.[2,3] Abdominal computed tomography can also detect small amounts of fluid but is more expensive. Unfortunately, there are no general guidelines for correlating small amounts of ascites seen on ultrasound examination or computed tomography with pathophysiologic conditions.

The "reference standard" for ascites is fluid aspiration by paracentesis and fluid visualization by ultrasound or computed tomography.

Pathophysiology of Ascites

Understanding the pathophysiologic basis for ascites facilitates assessment of each patient's risk by alerting the examiner to conditions disrupting normal physiology (Table 1). Under physiologic conditions, intravascular and extravascular hydrostatic and colloid osmotic pressures are balanced, preventing accumulation of extravascular fluid.[4]

Table 1. — Pathophysiologic Classification of Ascites*

I. Elevated hydrostatic pressure
A. Cirrhosis
B. Congestive heart failure
C. Constrictive pericarditis
D. Inferior vena cava obstruction
E. Hepatic vein obstruction (Budd-Chiari syndrome)
II. Decreased osmotic pressure
A. Nephrotic syndrome
B. Protein-losing enteropathy
C. Malnutrition
D. Cirrhosis or hepatic insufficiency
III. Fluid production exceeding resorptive capacity
A. Infections
1. Bacterial
2. Tuberculosis
3. Parasitic
B. Neoplasms

*Adapted from reference 13.

From the Ambulatory Care Service and The Center for Health Services Research in Primary Care, Durham Veterans Administration Medical Center, and the Division of General Internal Medicine, Duke University Medical Center, Durham, NC. Dr Williams is now with the University of Texas Health Science Center, San Antonio.

Reprint requests to Audie Murphy Memorial Veterans Hospital, 7400 Merton Minter Blvd, San Antonio, TX 78284 (Dr Williams).

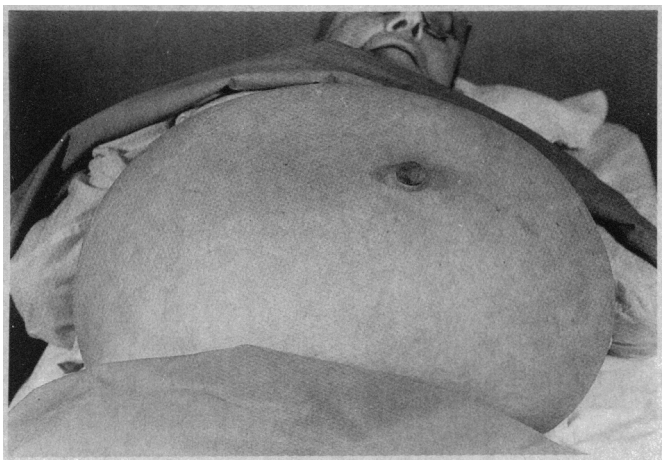

Fig 1.—Bulging flanks.

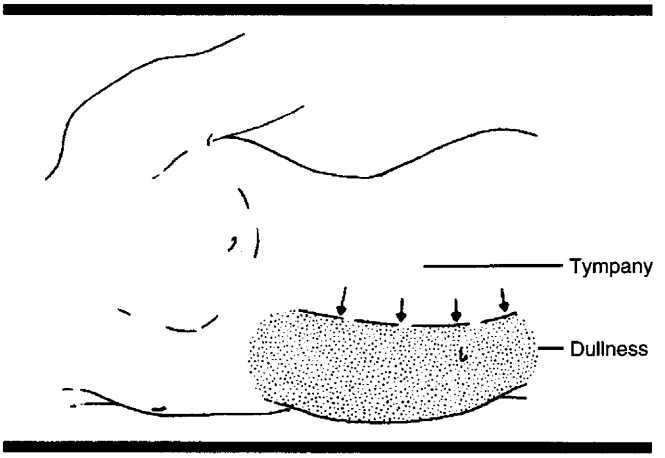

Fig 3.—Shifting dullness.

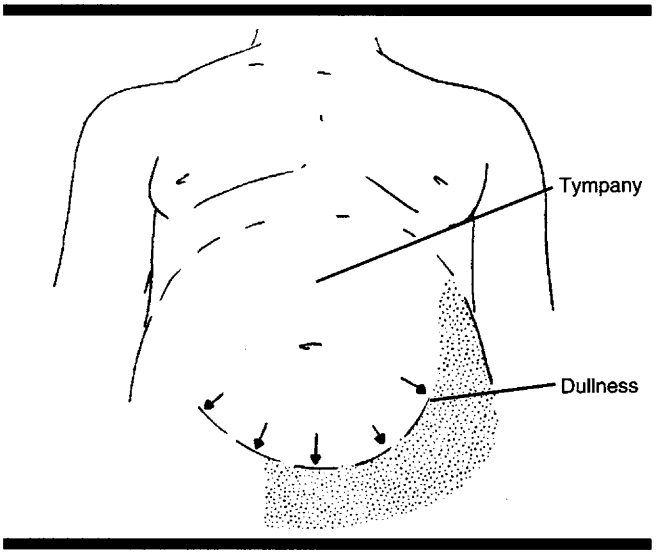

Fig 2.—Tympany and dullness.

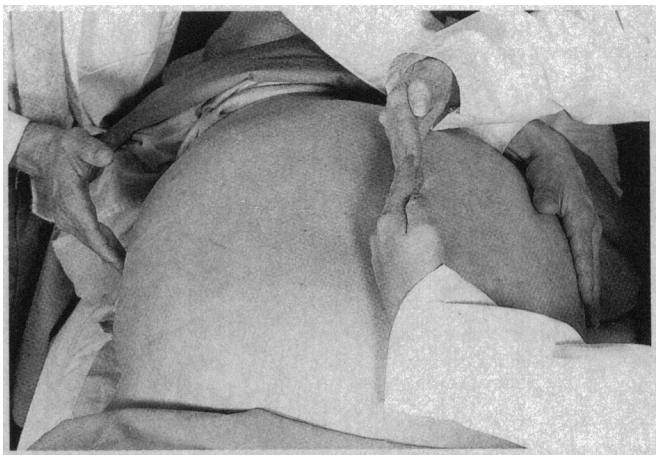

Fig 4.—Testing for a fluid wave.

Any process disrupting this balance may precipitate ascites. For example, fibrotic constriction of the hepatic sinusoids secondary to alcoholic cirrhosis leads to increased venous hydrostatic pressure and ultimately to ascites by forcing lymphatic drainage into the abdomen through the hepatic capsule.[1] Importantly, cirrhotic patients with ascites show avid renal retention of sodium and water, which is an important mechanism for continued ascites formation.[5] A second, less important mechanism for ascites formation is a loss of osmotic pressure due to inadequate protein synthesis (eg, malnutrition, liver disease) or protein wasting (eg, the nephrotic syndrome). As a result of protein loss, transudative fluid moves from the intravascular space into the abdominal extravascular space to balance hydrostatic and osmotic forces. Finally, infection or malignancy in the peritoneum may produce inflammatory exudates or malignant effusions in the abdominal extravascular space faster than it can be absorbed intravascularly.

How to Elicit the Symptoms and Signs of Ascites

A complete evaluation for ascites includes a focused history and physical examination. The examiner should ask about recent ankle edema, weight gain, or change in abdominal girth. Other potentially important items are a history of liver disease or congestive heart failure. A focused physical examination for ascites includes (1) inspection for bulging flanks, (2) percussion for flank dullness, (3) a test for shifting dullness, and (4) a test for a fluid wave.

Bulging flanks occur when the weight of abdominal free fluid is sufficient to push the flanks outward (Fig 1). However, it is sometimes difficult to distinguish bulging flanks caused by ascites from bulging flanks caused by obesity. One method for discriminating between the two is to test for flank dullness. With the patient recumbent, gas-filled loops of bowel will characteristically float on top of ascites, making the percussion note tympanitic at the umbilicus and dull beyond the fluid meniscus into the flanks (Fig 2). The examiner can confirm this pattern by progressively percussing the abdomen, beginning at the umbilicus and moving toward the flanks, listening for the transition from tympany to dullness when the meniscus is reached.[6] Having identified and marked the transition between tympany and dullness, further evidence for ascites can be obtained by testing for shifting dullness. This is done by rolling the patient away from the examiner and repeating the percussion. With ascites, the area of dullness shifts to the dependent side, and the area of tympany shifts toward the top (Fig 3).

Another potentially useful method for detecting ascites is testing for a fluid wave. The test is performed by having the patient, or an assistant, place the medial edges of both hands firmly down the midline of the abdomen to block transmission of a wave through subcutaneous fat (Fig 4). The examiner taps one flank sharply while using the fin-

gertips to feel for an impulse on the opposite flank. When ascites is present, an impulse may be felt in the receiving hand after a barely perceptible lag.

Two additional maneuvers, the puddle sign and auscultatory percussion, cannot currently be recommended. The puddle sign was initially advocated because of its purported high sensitivity.[7] However, it is infrequently used now because it is difficult to perform properly and has low sensitivity (43% to 55%).[8,9] A method of auscultatory percussion was described by Guarino,[10] but its precision and accuracy have not yet been reported. After voiding, the patient sits or stands so that free fluid gravitates to the pelvis, and the examiner places a stethoscope in the midline, immediately above the pubic crest. Finger-flicking percussion is performed along radial spokes from the subcostal margin downward toward the pelvis. The percussion note is initially dull, but changes sharply to a loud note at the border of increased pelvic density. In the absence of ascites, the border is approximately 4.5 cm above the pelvic crest (the pelvic baseline). In patients with ascites, free fluid raises the demarcating border clearly above the pelvic baseline. When the patient is supine, this clear line of demarcation is obliterated because the free fluid gravitates to the flanks.

Although most of the physical examination for ascites should focus on the abdomen, extra-abdominal signs may provide evidence for conditions associated with ascites. Physical findings that may be useful by their presence or absence include evidence of liver disease (eg, jaundice, spider angiomas) or heart disease (eg, cardiac gallop).

ACCURACY OF HISTORY AND SYMPTOMS FOR ASCITES

We examined the effect of medical history items on the probability of ascites in male veteran inpatients (Table 2).[8] Medical histories, obtained by internal medicine house staff, were compared with reference standard abdominal ultrasound findings. Positive histories of hepatitis or heart failure generated likelihood ratios (LRs) of 3.2 and 2.04, respectively. However, alcoholism (LR+, 1.44) or a history of carcinoma (LR+, 0.91) had little effect on the odds of ascites.

Other questions about the patient's present illness may be even more useful. In this same study, the patient's symptoms of increased abdominal girth, weight gain, or ankle edema gave LR+s of 4.16, 3.2, and 2.8, respectively. The absence of increased abdominal girth (LR−, 0.17) or ankle swelling (LR−, 0.10) decreased appreciably the diagnostic likelihood of ascites. For example, in a patient with a low pretest probability of ascites (<20%), the absence of recent ankle edema decreases the probability of ascites to less than 2.5%! Clearly, the patient's past medical history and current symptoms are valuable for at least two reasons. First, certain items may suggest the presence or absence of ascites. Second, in patients suspected of having ascites, a focused physical examination for ascites is needed. *The clinical history distinguishes patients with high and low probabilities for ascites. Ascites is unlikely when patients report no increase in abdominal girth, and ascites is very unlikely in male patients who report no history of recent ankle swelling.*

Table 2.—Accuracy of the Clinical History*

Historical Item or Symptom	Positive Likelihood Ratio (LR+)	Negative Likelihood Ratio (LR−)	Sensitivity	Specificity
Increased girth	4.16	0.17	0.87	0.77
Recent weight gain	3.20	0.42	0.67	0.79
Hepatitis	3.20	0.80	0.27	0.92
Ankle swelling	2.80	0.10	0.93	0.66
Heart failure	2.04	0.73	0.47	0.73
Alcoholism	1.44	0.69	0.60	0.58
History of carcinoma	0.91	1.01	0.13	0.85

*Adapted from reference 8.

Table 3.—Accuracy of the Physical Examination for Ascites

	Sensitivity			Specificity		
Sign	Cummings et al[12]	Simel et al[8]	Cattau et al[9]	Cummings et al[12]	Simel et al[8]	Cattau et al[9]
Flank dullness	...	0.80	0.94	...	0.69*	0.29
Bulging flanks	0.72	0.93	0.78	0.70	0.54	0.44
Shifting dullness	0.88	0.60	0.83	0.56	0.90*	0.56
Fluid wave	0.53	0.80	0.50	0.90	0.92	0.82
Puddle sign	...	0.43	0.55	...	0.83	0.51

*Test for heterogeneity suggests these values are significantly better across studies ($P<.01$).

Table 4.—Likelihood Ratios for the Physical Examination for Ascites*

	Likelihood Ratio Positive			Likelihood Ratio Negative		
Sign	Cummings et al[12]	Simel et al[8]	Cattau et al[9]	Cummings et al[12]	Simel et al[8]	Cattau et al[9]
Bulging flanks	2.4	2.0	1.4	0.4	0.1	0.5
Flank dullness	...	2.6	1.3	...	0.3	0.2
Shifting dullness	2.0	5.8	1.9	0.2	0.5	0.4
Fluid wave	5.3	9.6	2.8	0.5	0.2	0.6
Puddle sign	...	2.6	1.1	...	0.7	0.9
Peripheral edema	...	3.8	...	...	0.2	...

*Examiners were board-certified general internists in the study of Cummings et al, internal medicine house staff in that of Simel et al, and staff gastroenterologists in that of Cattau et al.

PRECISION OF THE SIGNS FOR ASCITES

Six gastroenterologists examined 50 hospitalized alcoholic patients for the presence or absence of ascites. Their overall agreement was good (intraclass correlation, 0.75), and it was excellent among senior physicians (0.95).[11] In another study, 90 veteran inpatients with evidence of liver disease were examined by three internists for four signs of ascites. For each sign there was good agreement: presence or absence of abdominal distention (86%), bulging flanks (79%), shifting dullness (78%), and detection of prominent fluid waves (76%).[12] *There is good agreement among physicians on the presence or absence of traditional signs for ascites.*

ACCURACY OF SIGNS FOR ASCITES

Three investigations have compared physical examination findings for ascites with findings from reference standard abdominal ultrasound examinations.[8,9,12] Despite the varied levels of training (internal medicine interns to staff gastroenterologists), the results were similar in each study (Table 3). There was no single sign for ascites that was both sensitive and specific. However, flank dullness (≥80%) and bulging flanks (≥72%) were sensitive in all studies. Shifting dullness had a high sensitivity (≥83%)

Table 5.—Pooled Results of Physical Examination Studies*

Physical sign	Positive Likelihood Ratio (LR+) (95% CI)	Negative Likelihood Ratio (LR–) (95% CI)	Sensitivity (95% CI)	Specificity (95% CI)
Bulging flanks	2.0 (1.5-2.6)	0.3 (0.2-0.6)	0.81 (0.69-0.93)	0.59 (0.50-0.68)
Flank dullness	2.0 (1.5-2.9)	0.3 (0.1-0.7)	0.84 (0.68-1.00)	0.59 (0.47-0.71)
Shifting dullness	2.7 (1.9-3.9)	0.3 (0.2-0.6)	0.77 (0.64-0.90)	0.72 (0.63-0.81)
Fluid wave	6.0 (3.3-11.1)	0.4 (0.3-0.6)	0.62 (0.47-0.77)	0.9 (0.84-0.96)
Puddle sign	1.6 (0.8-3.4)	0.8 (0.5-1.2)	0.45 (0.20-0.70)	0.73 (0.61-0.85)

*CI indicates confidence interval.

in two investigations. The puddle sign, purported to be the most sensitive test for ascites, performed poorly, yielding at best a sensitivity of 55%. The absence of a fluid wave was the only sign with a high specificity (82% to 92%) across all studies. Shifting dullness was highly specific in only one study[8]; inconsistent results may be due to differences in the study populations (general medical vs patients with liver disease). To date, no investigator has studied how to best use these signs in combination.

The clinician must know the pretest probability or prevalence of disease to apply sensitivity and specificity data to an individual patient. The likelihood ratios for the physical examination signs from the three studies are displayed in Table 4. We combined the study results based on the number of unique patients in each study to yield pooled sensitivity, specificity, and likelihood ratios (Table 5). The finding of a fluid wave, shifting dullness, or peripheral edema increased the likelihood of ascites the most. The absence of bulging flanks, flank dullness, shifting dullness, or peripheral edema decreased the likelihood of ascites the most.

Finally, is the whole greater than the sum of the parts? Is an examiner's overall clinical impression more accurate than individual signs or symptoms of ascites? Two studies evaluated the accuracy of the overall clinical assessment for ascites. In the study by Cattau et al[9] of patients who were referred because their physicians were unsure about the presence of ascites, the examiners correctly determined the presence or absence of ascites in only 56% of patients in this most difficult clinical scenario. In the study by Simel et al,[8] examiners categorized the probability of ascites as high, intermediate, or low. Examiners at all levels of training (intern through chief resident) were accurate when assigning a high probability of ascites (LR+, 37.7 to 83.3) but were less accurate at low probability of ascites (LR–, 0.77 to 0.87). Apparently a high suspicion of ascites in hospitalized patients was sufficient to make the diagnosis, but a low suspicion was not enough to rule out ascites. This rule may not apply for outpatients.

Following are three guidelines on which symptoms and signs are the most useful in determining whether a patient has ascites:

1. The most useful findings for ruling out ascites are negative histories of ankle swelling or increased abdominal girth, and the inability to demonstrate bulging flanks, flank dullness, or shifting dullness.

2. The most powerful findings for making the diagnosis of ascites are a positive fluid wave, shifting dullness, or peripheral edema.

3. The puddle sign is difficult to perform and uncomfortable for patients and is not sensitive to small amounts of ascites. It should not be performed.

This study was supported, in part, by a grant from the A. W. Mellon Foundation, New York, NY.

We wish to thank Jan Irvine, MD, and Valerie Lawrence, MD, for reviewing an earlier draft of this overview.

References

1. Bender MD, Ockner RK. Ascites. In: Sleisenger MH, Fordtran JS, eds. *Gastrointestinal Diseases and Pathophysiology: Diagnosis and Management.* 4th ed. Philadelphia, Pa: WB Saunders Co; 1989: 1943-1945.

2. Goldberg BB, Goodman GA, Clearfield HR. Evaluation of ascites by ultrasound. *Radiology.* 1970; 96:15-22.

3. Goldberg BB, Clearfield HR, Goodman GA, Morales JO. Ultrasonic determination of ascites. *Arch Intern Med.* 1973;131:217-220.

4. Guyton AC. *Textbook of Medical Physiology.* 7th ed. Philadelphia, Pa: WB Saunders Co; 1983: 836.

5. Schrier RW. Pathogenesis of sodium and water retention in high-output and low-output cardiac failure, nephrotic syndrome, cirrhosis, and pregnancy (2 parts). *N Engl J Med.* 1988;319:1065-1072, 1127-1134.

6. DeGowin EL, DeGowin RL. *Bedside Diagnostic Examination.* 4th ed. New York, NY: Macmillan Publishing Co Inc; 1982.

7. Lawson JD, Weissbein CA. The puddle sign—an aid in the diagnosis of minimal ascites. *N Engl J Med.* 1959;260:652-654.

8. Simel DL, Halvorsen RA, Feussner JR. Quantitating bedside diagnosis: clinical evaluation of ascites. *J Gen Intern Med.* 1988;3:423-428.

9. Cattau EL Jr, Benjamin SB, Knuff TE, Castell DO. The accuracy of the physical examination in the diagnosis of suspected ascites. *JAMA.* 1982; 247:1164-1166.

10. Guarino JR. Auscultatory percussion to detect ascites. *N Engl J Med.* 1986;315:1555-1556.

11. Espinoza P, Ducot B, Pelletier G, et al. Interobserver agreement in the physical diagnosis of alcoholic liver disease. *Dig Dis Sci.* 1987;32:244-247.

12. Cummings S, Papadakis M, Melnick J, Gooding GAW, Tierney LM. The predictive value of physical examinations for ascites. *West J Med.* 1985; 142:633-636.

13. Bender MD. *Diseases of the Peritoneum.* In: Wyngaarden JB, Smith LH, eds. *Cecil Textbook of Medicine.* 18th ed. Philadelphia, Pa: WB Saunders Co; 1988:790-793.