Interpreting Ascitic Fluid Analysis

What Is Ascitic Fluid Analysis?

Ascitic fluid analysis is a test we do when someone has fluid buildup in their belly (called ascites). We take a sample of the fluid with a needle (a procedure called paracentesis) and send it to the lab to figure out why the fluid is there. This helps us find the cause—like liver problems, infections, or even cancer—so we can treat it the right way. This guide makes it easy to understand how to interpret the results of ascitic fluid analysis, with helpful tips (clinical pearls) and examples to guide you in the hospital.

Why Do We Analyze Ascitic Fluid?

Ascites can happen for many reasons, like liver disease, infections, blood clots, or cancer. Analyzing the fluid helps us:

- Find the cause of the ascites (e.g., cirrhosis, infection, or cancer).
- Check for emergencies like an infection in the belly (called spontaneous bacterial peritonitis, or SBP).
- Decide how to treat the patient (e.g., antibiotics, diuretics, or more tests).
- Avoid missing serious problems like cancer or a hole in the intestines.

Step-by-Step Guide to Interpreting Ascitic Fluid Analysis

Let's break it down into simple steps to make it easy to understand.

Step 1: Look at the Appearance of the Fluid

When you first get the fluid, check how it looks:

- **Clear and Pale Yellow:** Usually means a simple cause like liver disease (cirrhosis).
- **Cloudy or Milky:** Could mean an infection (like SBP) or chylous ascites (fatty fluid from a lymphatic leak).
- **Bloody:** Might be from cancer, a blood clot, or trauma from the needle (if it clears up during the procedure, it's likely just from the needle).
- **Dark Brown or Green:** Could mean bile from a gallbladder or intestine problem (like a perforation).

Step 2: Check the Cell Count (White Blood Cells and Red Blood Cells)

- The lab will count the cells in the fluid:
- **White Blood Cells (WBC):**
  - **WBC >500/µL or Neutrophils >250/µL:** This means there's likely an infection like SBP, especially if the patient has cirrhosis. Start antibiotics right away!
  - **WBC >1000/µL with Lymphocytes Predominant:** Think about tuberculosis (TB) or cancer in the belly.
- **Red Blood Cells (RBC):**
  - **RBC >50,000/µL:** Suggests a bloody cause like cancer, a blood clot, or trauma.
  - **RBC <10,000/µL:** Usually not a concern, often just from the needle poke.

Step 3: Calculate the SAAG (Serum-Ascites Albumin Gradient)

The SAAG is a simple math trick to figure out why the fluid is there. You need two numbers: the albumin in the fluid and the albumin in the patient's blood (taken on the same day).

- **SAAG Formula:** SAAG = Serum Albumin (g/dL) - Ascites Albumin (g/dL).
- **What the SAAG Tells You:**
  - **SAAG ≥1.1 g/dL:** The ascites is from high pressure in the liver's blood vessels (called portal hypertension). Common causes are:
    - Cirrhosis (liver scarring).
    - Blood clot in the liver veins (hepatic vein thrombosis, aka Budd-Chiari syndrome).
    - Blood clot in the portal vein (portal vein thrombosis).
  - **SAAG <1.1 g/dL:** The ascites is NOT from high pressure in the liver. Think about causes like:
    - Infection (e.g., TB peritonitis).
    - Cancer in the belly (peritoneal carcinomatosis).
    - Pancreatitis (leaky pancreas fluid).
    - Nephrotic syndrome (kidney problem causing low albumin).

Step 4: Look at Total Protein and Albumin in the Fluid

These numbers help narrow down the cause even more:

- **Total Protein:**
  - **High Total Protein (>2.5 g/dL):** Suggests causes like TB, cancer, or a blood clot (because these cause leaky vessels in the belly).
  - **Low Total Protein (<2.5 g/dL):** Common in cirrhosis (liver can't make enough protein).
  - **Albumin in Fluid:** Used for the SAAG (see Step 3), but also helps confirm if the fluid is an "exudate" (leaky, high-protein fluid) or "transudate" (simple, low-protein fluid).

Step 5: Check for Infection (Culture and Gram Stain)

- **Culture:** If bacteria grow, it confirms an infection like SBP. Common bacteria in SBP are E. coli, Klebsiella, or Streptococcus.
- **Gram Stain:** Rarely shows bacteria (low sensitivity), but if positive, start antibiotics immediately.

Step 6: Look at Other Tests (If Needed)

- **Glucose:** Low (<50 mg/dL) in infections (SBP, TB), cancer, or gut perforation.
- **LDH:** High (>200 U/L) in infections or cancer (leaky vessels).
- **Amylase:** High (>100 U/L) in pancreatitis or gut perforation.
- **Cytology:** Looks for cancer cells (e.g., in peritoneal carcinomatosis).
- **Triglycerides:** High (>200 mg/dL) in chylous ascites (lymphatic leak).
- **TB Tests:** AFB smear, culture, or PCR if TB peritonitis is suspected.

Helpful Clinical Pearls

- Pearl 1: Always Calculate SAAG First
  - The SAAG is your best friend—it quickly tells you if the ascites is from liver pressure (≥1.1 g/dL) or something else (<1.1 g/dL). Don't skip this step!
- Pearl 2: Suspect SBP in Cirrhosis with Fever or Pain
  - If a patient with cirrhosis has fever, belly pain, or confusion, check the fluid right away. If neutrophils >250/μL, start antibiotics (like cefotaxime) even before cultures come back.

- Pearl 3: Bloody Fluid Needs More Tests
  - If the fluid is bloody (RBC >50,000/μL), think cancer, blood clot, or TB. Order cytology and consider imaging (like a CT scan) to look for tumors or clots.
- Pearl 4: Low Protein Means High Infection Risk
  - If the total protein in the fluid is <1.5 g/dL (common in cirrhosis), the patient is at high risk for SBP. They may need antibiotics to prevent infection (like norfloxacin 400 mg PO daily).
- Pearl 5: Don't Ignore Cloudy Fluid
  - Cloudy fluid often means infection (SBP, TB) or a fatty leak (chylous ascites). Check the cell count and triglycerides to figure out which one it is.
- Pearl 6: Glucose <50 mg/dL Is a Red Flag
  - A very low glucose in the fluid usually means a bad infection (like SBP or TB), cancer, or a hole in the gut. Act fast—order cultures and start antibiotics if infection is suspected.

Table: Interpreting Ascitic Fluid Analysis Results

Test	Result	What It Means	Next Steps
Appearance	Clear, pale yellow	Likely cirrhosis or liver vein clot	Calculate SAAG, check cell count
	Cloudy/milky	Possible infection (SBP, TB) or chylous ascites	Cell count, triglycerides, culture
	Bloody	Cancer, blood clot, or needle trauma	Cytology, imaging (CT), RBC count
SAAG	≥1.1 g/dL	Portal hypertension (cirrhosis, liver vein clot)	Ultrasound for liver/clot, manage liver disease
	<1.1 g/dL	Infection, cancer, pancreatitis	Cytology, culture, TB tests, amylase
WBC/ Neutrophils	WBC >500/μL or Neutrophils >250/μL	Likely infection (SBP)	Start antibiotics (e.g., cefotaxime), culture
	Lymphocytes predominant	TB or cancer	TB tests (AFB, PCR), cytology
Total Protein	>2.5 g/dL	TB, cancer, blood clot	Cytology, TB tests, imaging
	<2.5 g/dL	Cirrhosis, nephrotic syndrome	SBP prophylaxis if <1.5 g/dL
Glucose	<50 mg/dL	Infection (SBP, TB), cancer, gut perforation	Culture, antibiotics, imaging (CT)
Triglycerides	>200 mg/dL	Chylous ascites (lymphatic leak)	Imaging (CT for lymphatics), surgical consult

Table: Common Causes of Ascites and Fluid Findings

Cause	SAAG	Total Protein	Cell Count	Other Findings
Cirrhosis	≥1.1 g/dL	<2.5 g/dL	Usually low (<500/μL)	Clear fluid, risk of SBP if neutrophils >250/μL
SBP (Infection)	≥1.1 g/dL	<2.5 g/dL	Neutrophils >250/μL	Cloudy fluid, positive culture
Peritoneal Carcinomatosis	<1.1 g/dL	>2.5 g/dL	WBC >500/μL, lymphocytes	Bloody fluid, positive cytology
TB Peritonitis	<1.1 g/dL	>2.5 g/dL	Lymphocytes predominant	Low glucose, positive AFB
Pancreatitis	<1.1 g/dL	>2.5 g/dL	Variable	High amylase (>100 U/L)
Chylous Ascites	<1.1 g/dL	>2.5 g/dL	Variable	Milky fluid, triglycerides >200 mg/dL

Clinical Scenarios

Scenario 1: Cirrhosis with SBP

Presentation: A 55-year-old male with cirrhosis presents with fever, abdominal pain, and confusion. Exam shows T 38.5°C, BP 100/60 mmHg, HR 110 bpm, tender abdomen, no rebound.

Ascitic Fluid Analysis: Appearance: Cloudy, SAAG 1.5 g/dL, WBC 800/μL (neutrophils 600/μL), total protein 1.2 g/dL, glucose 70 mg/dL, culture pending.

Interpretation: SAAG ≥1.1 g/dL (cirrhosis), neutrophils >250/μL (SBP), low total protein (high SBP risk).

Management: Start cefotaxime 2 g IV q8h (SBP). IV fluids (NS 1 L bolus) for hypotension. Monitor TLS (uric acid, K+). Consult hepatology: SBP prophylaxis (norfloxacin 400 mg PO daily) on discharge. After 48h, fever resolves, cultures grow E. coli, antibiotics continued for 5 days.

Scenario 2: Peritoneal Carcinomatosis from Ovarian Cancer

Presentation: A 60-year-old female presents with abdominal distension and weight loss. Exam shows T 37°C, BP 120/80 mmHg, HR 90 bpm, distended abdomen, no tenderness.

Ascitic Fluid Analysis: Appearance: Bloody, SAAG 0.8 g/dL, WBC 600/µL (lymphocytes predominant), total protein 3.5 g/dL, glucose 40 mg/dL, cytology: Malignant cells (adenocarcinoma).

Interpretation: SAAG <1.1 g/dL (not portal hypertension), high protein, low glucose, malignant cells (peritoneal carcinomatosis).

Management: Admit for evaluation. Consult oncology: CT abdomen shows ovarian mass, CA-125 elevated, plan chemotherapy (carboplatin + paclitaxel). Therapeutic paracentesis (2 L removed) for symptom relief. Pleurodesis considered for recurrent ascites. Discharged on day 3 with oncology follow-up.

Scenario 3: TB Peritonitis in an Immunosuppressed Patient

Presentation: A 40-year-old male with HIV (CD4 100) presents with fever, abdominal pain, and distension. Exam shows T 38°C, BP 110/70 mmHg, HR 100 bpm, tender abdomen, no rebound.

Ascitic Fluid Analysis: Appearance: Cloudy, SAAG 0.9 g/dL, WBC 1000/µL (lymphocytes predominant), total protein 4.0 g/dL, glucose 30 mg/dL, AFB smear positive, TB PCR pending.

Interpretation: SAAG <1.1 g/dL, lymphocytes predominant, low glucose, AFB positive (TB peritonitis).

Management: Admit to isolation unit (TB). Start RIPE therapy (rifampin, isoniazid, pyrazinamide, ethambutol). Consult ID: Continue ART, monitor LFTs (drug toxicity). Prednisone 40 mg PO daily (TB immune reconstitution syndrome risk). After 7 days, fever resolves, TB PCR confirms Mycobacterium tuberculosis, discharged on RIPE therapy.