## Peritoneal Fluid Analysis

### Title: Peritoneal Fluid Analysis  
**Site(s):** All

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<th>Document #</th>
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<tbody>
<tr>
<td><strong>Section:</strong></td>
<td>Clinical Biochemistry &amp; Genetics</td>
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### Approved by:
- **Hayden Malvern**
- **Written By:** Dr. C Oleschuk

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<tr>
<th>#</th>
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<th>Approval:</th>
<th>Date:</th>
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<tbody>
<tr>
<td>1</td>
<td>New document</td>
<td>C Oleschuk</td>
<td>04-MAY-2010</td>
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</tbody>
</table>
| 2 | Added Total protein as acceptable test on this fluid  
Added Table 2 (interpretation of total protein in peritoneal fluid) | H Malvern | 21-JAN-2016 |
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Purpose
To describe the process for performing analysis on peritoneal fluid.

Background
Pathologic accumulation of fluid in the peritoneal cavity is called ascites. Approximately 80-85%, 10% and 3% of ascitic fluid accumulation is associated with hepatic cirrhosis, malignancy and cardiac failure, respectively. The liver and intestines are a source of peritoneal fluid that is drained from peritoneal cavity by lymphatics. If the capacity of the lymphatic system exceeds production of peritoneal fluid, fluid accumulates in the peritoneal space resulting in ascites.

Biochemical Analysis of Peritoneal Fluid
Biochemical analysis of ascites fluid provides information on its origin. Ascites fluid may be determined with a relatively high degree of specificity by biochemical analysis of the fluid. Testing for each of these analytes has been validated and reference intervals are provided where available.

Tests for Determining Origin of Ascites

1. **Bilirubin**: fluid from the biliary tract may accumulate in the peritoneal cavity with damaged bile ducts, for example post-surgery or abdominal trauma. This leakage may be determined by peritoneal fluid bilirubin analysis. Detection of high bilirubin concentration in peritoneal fluid is presumptive evidence for bile leakage.

2. **Amylase or Lipase**: Pancreatic damage causes extravasation of pancreatic enzymes from exocrine cells into peritoneal space. This process is precipitated as pancreatic enzymes can further damage pancreatic tissue resulting in further release pancreatic enzymes. Measurement of amylase or lipase in peritoneal fluid may be used to confirm or rule-out pancreatic injury.

3. **Creatinine, urea, glucose and pH**: Urine may accumulate in the peritoneal as a result of urinary obstruction from tumor, fibrosis, calculus or calculus therapy (shock wave lithotripsy), trauma and ureteral surgery. Urine extravasation will usually present with a high concentration of creatinine (144-884 umol/L or peritoneal creatinine: serum creatinine > 1.0 and urea and a low concentration of glucose and pH.

4. **Total Protein**: Peritoneal/ascitic fluid can be classified as an exudate if the total protein level is ≥25 g/L, and a transudate if it is below this cutoff. However, serum to fluid albumin gradient (SAAG) has replaced the exudate/transudate system of peritoneal fluid classification as it is a more useful measure for determining whether portal hypertension is present [1]. Despite its problems, the peritoneal fluid total protein concentration remains of some value in certain patients. Peritoneal total protein does not change with development of spontaneous bacterial peritonitis (SBP). Thus, a value of less than 10 g/L indicates a high risk of SBP [2,3]. Measurement of total protein, glucose, and lactate dehydrogenase (LDH) in peritoneal fluid may also be of value in distinguishing SBP from bowel perforation [4,5]. Patients with peritoneal fluid that has a corrected neutrophil count ≥250 cells/mm3 and meets two out of the following three criteria are unlikely to have SBP and warrant immediate action to determine if bowel perforation into ascites has occurred [4,5]:
• Total protein > 10 g/L
• Glucose < 2.8 mmol/L
• LDH greater than the upper limit of normal for serum

The total protein level also helps to differentiate uncomplicated ascites from cirrhosis from cardiac ascites, both of which have a SAAG ≥ 11 g/L. In the case of ascites from cirrhosis, the total protein is < 25 g/L, whereas in cardiac ascites it is ≥ 25 g/L. In patients with nephrotic ascites, the SAAG is < 11 g/L, and the total protein in the ascites of < 25 g/L.

The terms transudate and exudate and Light’s criteria are inadequate for distinguishing disease processes causing ascites. The current and preferred approach is to divide ascites fluid into high-gradient or low-gradient as determined by the serum-ascites albumin gradient = serum albumin – ascites fluid albumin. Gradients > 11 g/L are considered high and reflect a high hydrostatic pressure, most commonly due to cirrhosis. Examples of disease with high and low gradients are shown in Table 1. Serum and peritoneal/ascites fluid samples should be drawn on the same day.

<table>
<thead>
<tr>
<th>High Serum – Ascites Albumin Gradient</th>
<th>Low Serum – Ascites Albumin Gradient</th>
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<tbody>
<tr>
<td>Cirrhosis</td>
<td>Peritoneal carcinomatosis</td>
</tr>
<tr>
<td>Fulminent hepatic failure</td>
<td>Tuberculosis</td>
</tr>
<tr>
<td>Fatty liver</td>
<td>Pancreatic</td>
</tr>
<tr>
<td>Alcoholic hepatitis</td>
<td>Connective tissue disease</td>
</tr>
<tr>
<td>Portal vein thrombosis</td>
<td>Nephrotic syndrome</td>
</tr>
<tr>
<td>Veno-occlusive disease</td>
<td>Biliary (without cirrhosis)</td>
</tr>
</tbody>
</table>

Table 1: Diseases associated with ascites using Albumin

<table>
<thead>
<tr>
<th>Total Protein (g/L)</th>
<th>Other tests</th>
<th>Condition</th>
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<tbody>
<tr>
<td>≥25 g/L</td>
<td></td>
<td>Exudate</td>
</tr>
<tr>
<td>&lt;25 g/L</td>
<td></td>
<td>Transudate</td>
</tr>
<tr>
<td>&lt;10 g/L</td>
<td>High risk of spontaneous bacterial peritonitis (SBP)</td>
<td></td>
</tr>
<tr>
<td>≥10 g/L</td>
<td>Low risk of spontaneous bacterial peritonitis (SBP)</td>
<td></td>
</tr>
<tr>
<td>&lt;25 g/L</td>
<td>Ascites from liver cirrhosis</td>
<td></td>
</tr>
<tr>
<td>≥25 g/L</td>
<td>Cardiac ascites</td>
<td></td>
</tr>
<tr>
<td>&lt;25 g/L</td>
<td>SAAG &lt; 11 g/L</td>
<td>Nephrotic ascites</td>
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</tbody>
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Table 2: Diseases associated with ascites using Total Protein


