Paracentesis / Thoracentesis
An Overview

By Heather Molina, RT(R), PA-C, MMS
Topics

- To stick or not to stick???? QUIZ (Para)
- Ascites overview
  - Pathophysiology
  - Procedural techniques
  - Complications
- Pleural effusion overview
  - Procedural techniques
  - Complications
- Albumin or not?
- Academia vs. Private practices
Stick or Not?

A. Yes
B. Not without further work up
Stick or Not?

2

A. Yes
B. Not without further work up
Stick or Not?

3

A. Yes
B. Not without further work up
A. Yes
B. Not without further work up
Stick or Not?

5

A. Yes
B. Not without further work up
A. Yes
B. Not without further work up
Ascites

- Abnormal accumulation of fluid in the peritoneum
  - Usually serous fluid – yellow
  - But not limited to and can be bloody, orangish, amber, white, green to brownish in color
  - clear, cloudy, or with debris
Causes of Ascites

- Protein Loss
  - Cirrhosis

- Tight Junction Dysfunction
  - Malignancy
  - Infection
  - Pancreatitis

- Down Steam Occlusion
  - Heart failure
  - Renal failure
  - Portal occlusion
Causes cont.

- **Oncotic Pressure**: Also called colloid osmotic pressure, is a form of osmotic pressure exerted by proteins in a blood vessel's plasma (blood/liquid) that usually tends to pull water into the circulatory system. It is the opposing force to hydrostatic pressure.

- **Hydrostatic Pressure**: The pressure that the fluid exerts on the walls of its container ie. Down stream occlusion.
Pathophysiology of Ascites
Pathophys cont

normal situation
- intact tight junctions

brain tumor: VEGF
- tight junction dysfunction
- fenestrated endothelium
  → edema
Pathophys cont.

Filtration = Reabsorption + Lymph Flow

The interstitial volume (bounded area) depends on the rates of filtration, reabsorption and lymph flow.
Contraindications

- Uncooperative patients
- High risk for bleeding
- Acute abdomen that requires surgery
- Intra-abdominal adhesions
- Distended bowel
- Abdominal wall cellulitis at site of puncture
- Pregnancy (in most cases)
When to do a paracentesis

- When conservative measures no longer work
- Patients with discomfort and difficulty breathing
- Concern for infection
  - SBP vs. secondary bacterial peritonitis
- To determine etiology of fluid
  - Transudative vs. Exudative
Infection

- Spontaneous bacterial peritonitis (SBP)
  - No clear indication for infection
- Secondary bacterial peritonitis
  - Frequent paracentesis
  - Perforated bowel
  - Abscess
    - Higher Mortality associated
Confirming Infection

- Symptoms: Fevers, chills, nausea, vomiting, abdominal pain, general fatigue, encephalopathy
- Elevated Neutrophil count of ascitic fluid
- Source of infection
  - CT Scan
  - Surgery
  - Autopsy
# Etiology of Ascitic Fluid

<table>
<thead>
<tr>
<th></th>
<th>Transudate</th>
<th>Exudate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAUSE</strong></td>
<td>Increased hydrostatic pressure, CHF, ESLD, Nephrotic syndrome, SVC syndrome, glomerulonephritis</td>
<td>Inflammation, pneumonia, malignancy, pulmonary TB, pancreatitis, ovarian neoplasm, SLE, RA, drug induced, uremic pleuritis</td>
</tr>
<tr>
<td><strong>COLOR</strong></td>
<td>Clear, water-like, or pale yellow</td>
<td>Cloudy, white, yellow or red</td>
</tr>
<tr>
<td><strong>CONSISTENCY</strong></td>
<td>Thin and watery, no tissue fragments</td>
<td>Thick and creamy, contains tissue fragments</td>
</tr>
<tr>
<td><strong>ODOR</strong></td>
<td>None</td>
<td>May have an odor</td>
</tr>
<tr>
<td><strong>pH</strong></td>
<td>Alkaline</td>
<td>Acid</td>
</tr>
<tr>
<td><strong>SPECIFIC GRAVITY</strong></td>
<td>1.015 or lower</td>
<td>1.018 or higher</td>
</tr>
<tr>
<td><strong>PROTEIN CONTENT</strong></td>
<td>Low, less than 3%</td>
<td>High, more than 4%</td>
</tr>
<tr>
<td><strong>CELL COUNT</strong></td>
<td>Low, none or few WBC and RBC</td>
<td>High, many WBC and RBC</td>
</tr>
<tr>
<td><strong>ENZYME CONTENT</strong></td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td><strong>BACTERIA</strong></td>
<td>None</td>
<td>May be present</td>
</tr>
<tr>
<td><strong>INFLAMMATION</strong></td>
<td>None present</td>
<td>Associated with inflammation</td>
</tr>
</tbody>
</table>
Complications with para

- **Bleeding**
  - Peritoneal layer
  - Internal bleeding

- **Infection**
  - Skin
  - Fluid

- Puncture to liver, bowel or other abdominal structures

- Loss of catheter in skin or peritoneum

- Post procedural hypotension

- Post procedural hyponatremia

- Spontaneous hemoperitoneum
  - Rare complication associated due to mesenteric variceal bleeding after LVP

- Hepatorenal syndrome (HRS)
Safe to stick

Image 2 – Showing bowel

Image 4 - Loculations

Image 6 – Showing liver
Oops! Should have done further work up.

Image 1 - Carcinomatosis

Image 3 – Renal cyst

Image 6 – Ovarian cyst
Hepatorenal Syndrome (HRS)

- Precipitating factors of HRS
  - Sepsis
  - UGI Bleed
  - Paracentesis
  - Nephrotoxic drugs
    - Loop diuretics
    - Antibiotics
    - NSAIDS
Treatment/ management options for recurrent ascites

- Tunneled drainage catheters
  - Pleurx, Aspira, Denver shunt
  - Usually Hospice patients- (Low protein state)
- TIPS- Up stream occlusion
- Lymph angio with embolization
  - Not quite as common
- Surgery
  - Liver, kidney, heart transplant
Procedural techniques

- Why most patients complain of pain
- Why size matters
- Why amount matters
- The Z technique
- Location/Location/Location
Complaints of pain

- Typically seen when the area is not numbed up to the most distal peritoneal layer.

- The area being numbed up is not the same area that was re-entered when going accessing the fluid.
Size can matter
Amount removed

- Hypotension
- Hyponatremia
- Feeling of illness due to massive fluid shift
Albumin

- Protein replacement
- 5-8 g/dl per liter after 5 liters removed
- Reduces protein leaking
- Helps resolve hypotension, hypovolemia, renal impairment, and hyponatremia
The “Z” technique
Location
Safety Needles

- **Self-sealing valve**
  Maintains closed system or allows for reinsertion of introducer needle or guide wire for procedures not requiring maintenance of a closed system.

- **Visual color indicator**
  Transitions to red when sharp distal tip is exposed and returns to “Safe-White” when spring-loaded obturator is automatically extended, presenting an ultra-traumatic front to injury.

- **Silicone coating**
  Allows for smooth percutaneous insertion while minimizing potential for ‘accordion’ effect and reducing tissue trauma.

- **Catheter modularity**
  For procedures not requiring maintenance of a closed system, the luer lock connection allows convenient removal of pigtail catheter from valve assembly.

- **Centimeter depth markings**
  Reliable reference for safe catheter placement with 16 cm of usable catheter length.

- **Pigtail catheter**
  Self-directing and occlusion-resistant.

- **Remote stopcock**
  Provides procedural convenience and safety by facilitating connection to drainage/extension sets while minimizing inadvertent device or catheter movement.

- **Vanes’ technology dual-lumen blunt obturator**
  Provides patient protection from perforations and user protection from needlestick injuries.

- **Minimally invasive 6 Fr or 8 Fr size**

Diagram A

Diagram B
Thoracentesis – Pleural Effusion

- Abnormal amount of fluid in the pleural cavity.
- The body makes a small amount for easy gliding of the lungs.
Pleural fluid

- Presses on the lungs and causes atelectasis.
- Fluid creates positive pressure
Indications for Thoracentesis

- Symptomatic relief of shortness of breath for large pleural effusions
- Diagnostic purposes
- Diagnose and treat empyema’s
Pleural Effusions on ultrasound
Pleural Effusion on X Ray and CT
Contraindications of Thoracentesis

- High risk of bleeding
  - INR > 1.5
  - Platelets < 50
- Uncooperative patient
Procedural Techniques
Complications of Thoracentesis

- Bleeding
- Infection
- Pneumothorax
- Injury to other structures
  - Liver
  - Spleen
- Re-expansion Pulmonary edema
Pneumothorax

- With image guidance very low chance of hitting lung and causing PTX
- Pneumothorax can be caused by letting air in catheter
- Post-op Chest x-ray

- Difference between Pneumothorax with air trapped in the pleural space and with “Trapped lung” that can’t expand. Sometimes called “Pneumothorax ex vacuo”
Pulmonary Edema

Normal lung tissue vs. Pulmonary Edema:
- Normal: Clear alveoli, no fluid build-up in lungs
- Pulmonary Edema: Fluid build-up in alveoli, fluid leakage into lungs

Lung tissue is enlarged and heavy.
Pulmonary Edema on Imaging
I have liver disease, why is it in my lungs and not my belly?

- Hepatic Hydrothorax
- When a patient has a recurrent pleural effusion and not ascites
- Small microscopic tears in the diaphragm
- With breathing this sucks the fluid into the pleural space
Treatment/ Management of Pleural Effusion

- Thoracentesis
- Chest Tube
- Pleurodesis
- Pleural Drain
  - Pleurx, Aspira, Denver shunt
- Pleural Decortication
Academia vs Private Practice

- Reasons for pleurx
- Amount of fluid being removed
- Amount of albumin to give
References


- http://faculty.wwu.edu/vawter/PhysicsNet/Topics/Pressure/HydroStatic.html


- http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3020354/


- http://www.uptodate.com/contents/hepatic-hydrothorax