PERITONEAL (ABDOMINAL) PARACENTESIS

Indications

1. To determine the cause of ascites.
2. To determine if ascites is infected.
3. For therapeutic removal of fluid:
   (a) When distention is pronounced and/or tense, or there is respiratory distress associated with abdominal distention (acute treatment).
   (b) As an alternative to diuretic therapy for speed of treatment, or when diuretics are ineffective and renal function is stable (chronic treatment).
4. To determine if intra-abdominal bleeding is present, or a viscus has ruptured, or to diagnose acute hemorrhagic pancreatitis (with or without diagnostic peritoneal lavage).

Contraindications

Uncertainty if distention is due to peritoneal fluid, intestinal distention or the presence of a cystic structure. Ultrasound or CT guidance may be needed in this case. Coagulopathy and thrombocytopenia are not contraindications to diagnostic paracentesis. If therapeutic paracentesis must be done and there is concern for a bleeding risk (INR > 2.5 and platelets less than 40,000), fresh frozen plasma and platelets may be needed. Experience at Mayo Clinic with 1,100 outpatient large volume paracenteses showed that no complications occurred even with INR 8.7 and platelet count 19,000/cu.mm

Complications

These are rare if the correct procedure is followed, but could include perforation of a viscus (mostly commonly the intestine), hemorrhage, introduction of infection, or precipitation of circulatory collapse and/or renal failure if adequate colloid replacement is not given following large volume paracentesis over 5L.

Specific limitations of the procedure

It may be difficult to obtain peritoneal fluid if there is massive obesity or another cause of thickening of the anterior abdominal wall. Paracentesis may be difficult when there are multiple abdominal scars or there is intestinal dilatation or loculation of peritoneal fluid. Loculation of ascites is also a cause of failure of therapeutic paracentesis.
How to perform the procedure

1. **Preparation:** Paracentesis should be performed under strict sterile conditions. The abdomen should be cleaned, disinfected (clean skin site with povidone-iodine, unless the patient has an iodine skin allergy) and draped in a sterile fashion, and the physician should wear sterile gloves. Wear cap if hair is long; tuck in ties and other loose clothing or pendants.

2. The skin and subcutaneous tissue should be infiltrated with a local anesthetic (1% lidocaine without epinephrine). If the abdominal wall is only a few millimeters thick, anesthesia is not necessary since diagnostic paracentesis needle insertion is less painful than the anesthetic.

3. The entry site is almost always in the lower abdominal quadrants or midline, avoiding subcutaneous collateral veins and surgical scars. The site should always be below the percussed air fluid level and chosen to be that which is dullest to percussion. There must be dullness at the site selected for needle entry, which therefore may require that the patient is placed in the lateral or semilateral decubitus position (for a lateral tap); the semi-recumbent position is necessary for a midline tap. The mid-clavicular line should be avoided because of the inferior epigastric artery. A lateral tap should be avoided on the right side if there is massive hepatomegaly, and on the left side if there is massive splenomegaly, i.e. make sure that the entry site is below liver or spleen. Under normal circumstances, a left lateral lower abdominal tap is preferred because the colon is not fixed on this side and can float away from the needle, whereas the cecum is a fixed retroperitoneal structure. For a midline tap, the patient must first empty the bladder or be catheterized. If no clear air/fluid level can be percussed or fluid cannot be obtained, ultrasound is recommended for guidance. When relatively small amounts of fluid are detected by ultrasound, the paracentesis must be done with/by the sonographer to ensure safe and accurate needle placement. Marking a site with sonography for *later* paracentesis is an exercise in self-deception since the position of the patient and/or ascites may differ for sonography and later paracentesis. Spontaneous bacterial peritonitis can even occur in the presence of only a few cc’s of peritoneal fluid, although usually the volume of fluid is large.

4. **Choice of needle:** For **diagnostic purposes** a 1.5 inch 19–22 gauge metal needle or 20 gauge Angiocath is used, with a minor procedure tray. In patients with a thick anterior abdominal wall (due to obesity, edema or other cause), 3.5 inch 18–20 gauge spinal needles may be necessary. Bare steel needles are preferable to plastic-sheathed cannulas, because of the tendency of the plastic sheath to kink or collapse and impede flow of fluid after the metal trocar is removed. The metal needles do not puncture bowel unless there is a scar or severe gaseous distention. When there is a severe bleeding risk, a fine caliber needle (22–23 gauge) should be used. For **therapeutic purposes**, a special needle and “large volume paracentesis kit” (GI Supply) should be used.
5. Manner of insertion: Use of a “Z-track” minimizes leakage of fluid after the tap is completed, especially in patients with tense ascites. To create a “Z-track” the skin should be moved (1 cm in any direction) in relation to the deep abdominal wall, and the paracentesis needle is then inserted. The skin is not released until the needle has penetrated the peritoneum and fluid flows freely. After the fluid is obtained, the needle is rapidly withdrawn and the skin slips back to its original position and seals the leak.

The needle should be advanced slowly. A slow incremental insertion allows the operator to see blood in the syringe if a vessel is entered, and allows withdrawal of the needle before there is further damage. A slow insertion also allows the bowel to move away from the needle so that the bowel is not entered. The syringe that is attached to the needle should not be aspirated continuously during the insertion. If this is done, bowel or omentum may be suctioned to the end of the needle when it enters the peritoneal cavity, giving the appearance of a “dry” tap. The needle should be inserted a little at a time; the syringe is aspirated for a few seconds while the needle is stationary. The needle is advanced and aspirated repeatedly until the “giving” sensation of entering the peritoneal cavity is felt (this may be painful for the patient) and fluid is obtained. The peritoneum is tough and considerable pressure may be needed to penetrate it for therapeutic paracentesis (see later). For therapeutic paracentesis, the pointed trocar may then be withdrawn and the “blunt” end hole/many side hole canula inserted deeper.

Once fluid is flowing, the needle should be stabilized so that its depth of insertion and direction can be maintained to ensure a steady flow. If the needle is not stabilized and it moves in and out of the peritoneal cavity, subcutaneous blood may contaminate the contents of the syringe. If bowel or omentum is suctioned over the needle and occludes it, it is not unusual for flow of fluid to stop. When this occurs the syringe should be removed from the needle, which is then twisted and inserted or withdrawn slightly and slowly until fluid drips from the hub. The syringe is re-attached and the fluid aspirated.

6. Quantity of fluid removed: For routine diagnostic paracentesis at least 30cc’s are required. For therapeutic paracentesis, anything from a couple of liters (for comfort) to “total volume” may be removed.

Tests on ascitic fluid

Irrespective of the reason for paracentesis, cell count, differential and culture should be sent every time. Total protein and albumin (with simultaneous serum albumin), should be done for all first time diagnostic paracenteses. Amylase, lipase, triglycerides, cytology, and/or lipoprotein electrophoresis should be sent when appropriate.
Fluid for chemistry is placed in a plain red top tube.
Fluid for cell count and differential is placed in a lavender top tube.
Fluid for culture is injected into aerobic and anaerobic blood culture bottles at the bedside.
Fluid for TB and fungal culture is placed in a sterile plain container (e.g. red top tube or sterile specimen container).

For routine diagnostic paracentesis, measurements of glucose, LDH, and gram stain are not useful. Cytology is best done on volumes of 200ml or more (preferably not sent on the afternoon before a weekend or holiday). When diagnostic paracentesis is done to diagnose spontaneous bacterial peritonitis (SBP), simultaneous blood cultures should be done in case organisms do not grow from the peritoneal fluid (so-called culture negative neutrocytic ascites). SBP is a blood-borne infection.

**LARGE VOLUME PARACENTESIS**

A larger bore needle is used. A GI Supply Large Volume Paracentesis Kit and additional bags for collection, should be ordered in advance. See separate sheet for use of the kit and peristaltic pump.

The physician should remain at the bedside throughout the paracentesis (20-40 minutes depending on the amount of ascites removed). When “total paracentesis” is performed, the procedure ends when the flow from the needle becomes intermittent despite gentle mobilization of the cannula within the abdominal cavity and turning the patient towards side of entry. After paracentesis, patients should lie on the opposite side to the puncture site for two hours, to prevent fluid leakage. The intravenous administration of albumin (6 to 8gm per liter of ascites removed) is initiated after the procedure, when greater than 4-5 liters are removed. There is not yet sufficient data on the use of other plasma volume expanders; albumin is still the replacement of choice. In patients on chronic diuretics, it is advisable to ensure that circulatory volume depletion is not present prior to large volume paracentesis, by discontinuing diuretics for a day or two prior to an elective procedure, administering intravenous albumin beforehand if there is impairment of renal function or postural hypotension, and even performing the procedure with guidance of central venous pressure monitoring.

**Note on interpretation of laboratory results of ascitic fluid**

The concept of transudate versus exudate has been abandoned in the case of ascites because high total protein concentrations may be found in so-called transudates (ascites due to right heart failure, constrictive pericarditis, etc) and low protein concentrations may be found in the presence of peritoneal infection (i.e. cirrhotic ascites with SBP). For this reason it is recommended to measure both total protein and albumin in ascites as well as simultaneous serum albumin.
When the difference between the serum albumin and ascitic albumin concentration (so-called Serum Ascites-Albumin Gradient or SAAG) exceeds 1.1 g/dl, this indicates the presence of portal hypertension as may occur in cirrhosis, but it also occurs in elevated hepatic venous pressures (as in hepatic venous thrombosis and right heart failure) and, rarely, with extensive malignant infiltration of the liver (which mimics portal hypertension). The interpretation is more reliable, the higher the SAAG. In cirrhotic ascites, the ascitic fluid total protein concentration is usually less than 2.5g/gl, whereas in cardiac ascites, peritoneal carcinomatosis and miscellaneous other causes, ascitic fluid total protein concentrations usually exceed 2.5g/dl.

An absolute polymorph leukocyte count in ascitic fluid in excess of 250/cu.mm indicates spontaneous bacterial peritonitis (SBP), especially in appropriate clinical circumstances. Ascitic fluid LDH, lactate or pH are very rarely useful. Ascitic fluid LDH levels are rarely required but may be elevated in the presence of infection and malignancy. In secondary infections (e.g. perforation) ascitic fluid glucose levels are reduced compared to plasma, but these are rarely useful either. Bacterial ascites infection can occur without an elevated ascites neutrophil count (so-called bacterascites), which frequently is clinically significant. Ascites culture is not always positive even when the absolute neutrophil count exceeds 250/cu.mm (neutrocytic ascites); treatment for SBP should be given until proved otherwise.

White cell counts higher than 10,000/cu.mm suggest the presence of secondary peritonitis (such as due to a perforated viscus). This diagnosis should also be highly suspected if more than one organism grows in ascitic fluid cultures (especially if fungi or anaerobes are present). The possibility of secondary bacterial peritonitis should also be considered if ascites culture continues to be positive despite treatment or if there is an increase rather than a decrease in ascites polymorph leukocyte count, when the patient receives appropriate antibiotic therapy.

If ascitic fluid appears cloudy, samples should be sent for centrifugation, triglyceride and chylomicron estimation looking for particulate material and chylous ascites, respectively. If triglyceride content is not especially high, chylous ascites may still be diagnosed by lipoprotein electrophoresis showing chylomicrons. Ascitic fluid amylase concentrations more than threefold greater than those of serum suggest the presence of pancreatic ascites.

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