Ascites - what is important to describe

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Authors: O. C. Saito¹, E. Nagaya¹, M. C. Chammas¹, S. M. Tochetto², A. C. Gomes¹, Y. C. S. Neves³, B. S. Nunes¹; ¹Sao Paulo/BR, ²Chicago, IL/US, ³Salvador, Ba/BR
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Learning objectives

- Discuss the importance of peritoneal anatomy and flow pathways in assessing the spread of disease through the peritoneal spaces;
- Identify potential causes for ascites;
- Describe the most important findings of ascites in ultrasonography (US) and computed tomography (CT);
- Recognize what is important to search in US and CT.

Background

Ascites is the pathologic accumulation of fluid within peritoneal cavity. Whereas it has numerous causes, the two most common imaging methods used, US and CT, usually depict its characteristics and anatomic relations and help narrowing the diagnostic possibilities.

The US has the advantages of being a low-cost, portable and ionizing radiation-free method. US can also guide paracentesis and other procedures. On the other hand, it does not provide a global anatomic view of the abdominal cavity. CT fully delineates the peritoneal cavity anatomy, allowing an accurate evaluation of disease processes and its spread.

Findings and procedure details

ANATOMIC CONSIDERATIONS

The peritoneum is the largest serous membrane of the body, consisting of a single layer of cuboidal cells that line the abdominal wall (parietal peritoneum) and internal organs (visceral peritoneum). The space between these two layers is called the peritoneal cavity, and it's filled by 50-100 mL of serous fluid in physiological states, creating a capillary film that lubricates the surfaces and allows sliding of the viscera. In women, the peritoneal cavity communicates with the body exterior through the Fallopian tubes, uterus and vagina.
The peritoneal reflections are called ligaments and are double folds of peritoneum that support structures within the peritoneal cavity. They divide the peritoneum into two major compartments: the greater sac, which is the main region, and the omental bursa or lesser sac, a diverticulum.

The omentum and the mesentery are also considered ligaments. The first originates from the stomach and duodenal bulb to adjacent organs. It is further divided into lesser omentum (made of the continuous gastrohepatic and hepatoduodenal ligaments) and greater omentum, which hangs like an apron from the greater curvature of the stomach to the inferior transverse colon (Fig. 1 on page 5).

Mesentery is the general denomination for a double layer of peritoneum (ligament) that encloses an organ and connects it to the peritoneal wall (mostly the dorsal wall). It contains blood vessels, lymph nodes, nerves and fat. The most mobile parts of the intestine have a mesentery (small bowel, transverse and sigmoid colons), and retroperitoneal portions of the colon may contain an embryological remnant of mesocolon as a result of its failure to reabsorb.

The transverse mesocolon is a peritoneal fold that attaches the transverse colon to the retroperitoneum; it divides the peritoneal cavity into the supramesocolic and the inframesocolic spaces. In this review we will focus in the inframesocolic spaces (Fig. 2 on page 6) as it has the more relevance in the fluid pathways created by the different forces acting in the abdominal cavity.

The small bowel mesentery attaches the small bowel to the retroperitoneum and extends from the ligament of Treitz to the ileocecal valve. It's position is easily demonstrated in a contrast-enhanced CT since it contains the superior mesentery vessels and their branches. It further divides the inframesocolic spaces into a smaller right inframesocolic space and a larger left inframesocolic space. They are separated from the paracolic gutters laterally by the ascending and descending colons.

The right inframesocolic space is limited inferiorly by the attachment of the small bowel mesentery to the cecum; hence, fluid accumulations in this compartment usually do not extend into the pelvis. The left inframesocolic space, on the other hand, is open anatomically to the pelvis.

The paracolic gutters are peritoneal spaces lateral to the ascending and descending colons (their peritoneal reflections), continuous inferiorly with the pelvic spaces. The right paracolic gutter is larger and communicates freely with the right subphrenic space. However, the connection of the left paracolic gutter with the supramesocolic spaces is partially limited by the phrenicocolic ligament.
The forces that act in the peritoneal environment generating flow are mainly the gravitational force (towards inferior parts of the body, in orthostasis) and the forces involved in the respiratory movements (upward). Fluid accumulations tend to occur in the most gravity dependent site (rectovesical space in men and retrouterine space - pouch of Douglas - in women; both are part of the pelvic space). The fluid descends from the left inframesocolic space to the pelvis. It then goes up mainly through the right paracolic gutter to the supramesocolic spaces. This route is the key to understand disease spread, such as ovarian and colorectal cancers with peritoneal implants. For a clearer view of flow pathways, take another look at Fig. 2 on page 6.

MOST IMPORTANT FINDINGS AND ETIOLOGY

US is the least expensive method for diagnosing ascites as it is very sensitive to detecting small amounts of fluid in the recesses.

Once the fluid within peritoneal cavity is identified, it is important to evaluate:

- echogenicity of the fluid;
- extension of the fluid;
- presence or not of septations and
- presence or not of debris

Generally, anechoic fluid without septations or debris is suggestive of transudative ascites. On the other hand, loculated fluid collections, debris and septations are suggestive of exudative ascites or hemorrhage. With this distinction, some diagnostic hypothesis can be strengthened seeking ancillary features on the US evaluation.

It is important to be familiar with the main causes of transudative ascites, which are:

- hepatic cirrhosis;
- alcoholic hepatitis;
- heart failure;
- hypoproteinemia;
- portal vein thrombosis;
- peritoneal dialysis and
- malignancy (10% of refractory ascites) - most common: breast, ovarian, endometrial, gastrointestinal and pancreatic.

The most common causes of exudative ascites are:

- peritoneal carcinomatosis;
- pancreatitis;
- abscess;
- nephrotic syndrome;
- peritonitis (e.g. tuberculosis);
- ischaemic bowel and
- bowel obstruction

Although ultrasound is more sensitive, CT can be more valuable for the evaluation of potential causes for ascites. The first clue to help elucidate the diagnosis is the fluid density measurement:

- density similar to subcutaneous tissue suggests chylous ascites, (Fig. 3 on page 7);
- attenuation between -10 to +10 UH (approximate to water) suggests transudative ascites;
- density over +15 UH suggests exudative density and
- density over +45 UH suggests haemoperitoneum (Fig. 4 on page 7).

Moreover, it is important to search ancillary features such as:

- lymphadenopathy;
- intraabdominal mass;
- nodules suggestive of peritoneal seeds (Fig. 5 on page 8);
- hepatic metastases and
- pancreatic fistula

It is important to emphasize that sampling always is required to confirm diagnosis.

Images for this section:
**Fig. 1:** Figure 1. Peritoneal spaces and ligaments, sagital view. Illustration shows the relations between peritoneal layers and internal organs.

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**Fig. 2:** Figure 2. Posterior peritoneal reflections and intraabdominal spaces, anterior view. TrM = transverse mesocolon, PL = phrenicocolic ligament, SBM = small bowell
mesentery, AC = attachment of ascending colon, DC = attachment of descending colon, SM = sigmoid mesocolon, R = rectum, B = urinary bladder, RIS = right infracolic space, LIS = left infracolic space, RPG = right paracolic gutter, LPG = left paracolic gutter. On the right, a diagram showing the pathways of flow of intraperitoneal fluid and the four predominant sites of accumulation in the lower abdomen. Modified from Reference 1.

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**Fig. 3:** Chylous ascites. Abdominal US and CT of a 35 year old man with a history of blunt abdominal trauma. US shows loculated ascites with multiple septations. CT shows abdominal loculated fluid with density of - 65 UH suggestive of chylous ascites. It was performed a paracentesis confirming high fat (triglyceride) content.

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**Fig. 4:** Abdominal trauma. CT shows intraperitoneal hyperdense fluid, with density of +35 UH, suggestive of haemoperitoneum.

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**Fig. 5:** Peritoneal carcinomatosis. Abdominal US and TC of a 50 year old woman with increased abdominal size and weakness. US and CT shows multiple nodules attached to the peritoneal wall. In US the ascites is anechoic without septations or debris and in CT the density of the fluid is + 10 UH suggestive of transudative ascites. The patient was diagnosed with ovarian tumor.

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**Fig. 6:** Pancreatic fistula. Abdominal US and CT of a 56 year old man with a history of alcoholism and acute pain in the upper abdomen. US shows a liver with signs of chronic disease and anechoic ascite without septations. CT shows collections in the topography of pancreatic tail and third duodenal portion (green circle), with peripheral enhancement and an apparent fistula hole with duct Wirsung. The density of the ascites is + 13UH, suggestive of exudative ascites, confirmed by paracentesis that revealed the presence of amylase and lipase in the abdominal fluid.

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Conclusion

- A comprehensive understanding of the abdominal cavity anatomy, with its peritoneal spaces and fluid pathways, is essential in assessing the extension and spread of abdominal diseases.

- US is particularly valuable in evaluating ascites, dividing the most common causes of fluid accumulation in two major categories (transudative and exsudative ascites) by means of its findings. Furthermore, it is low cost, doesn’t involve ionizing radiation and is an accessible tool that can be used to guide many routine procedures.

- CT precisely delineates the abdominal cavity anatomy and provides complementary findings that narrow the diagnostic possibilities.

- A rational use of both methods is the key to determine the cause and extension of the peritoneal disease, combined with clinical and laboratory features.

Personal information

References


