Abdominal Ultrasound
Chapter 7

THE RETROPERITONEUM

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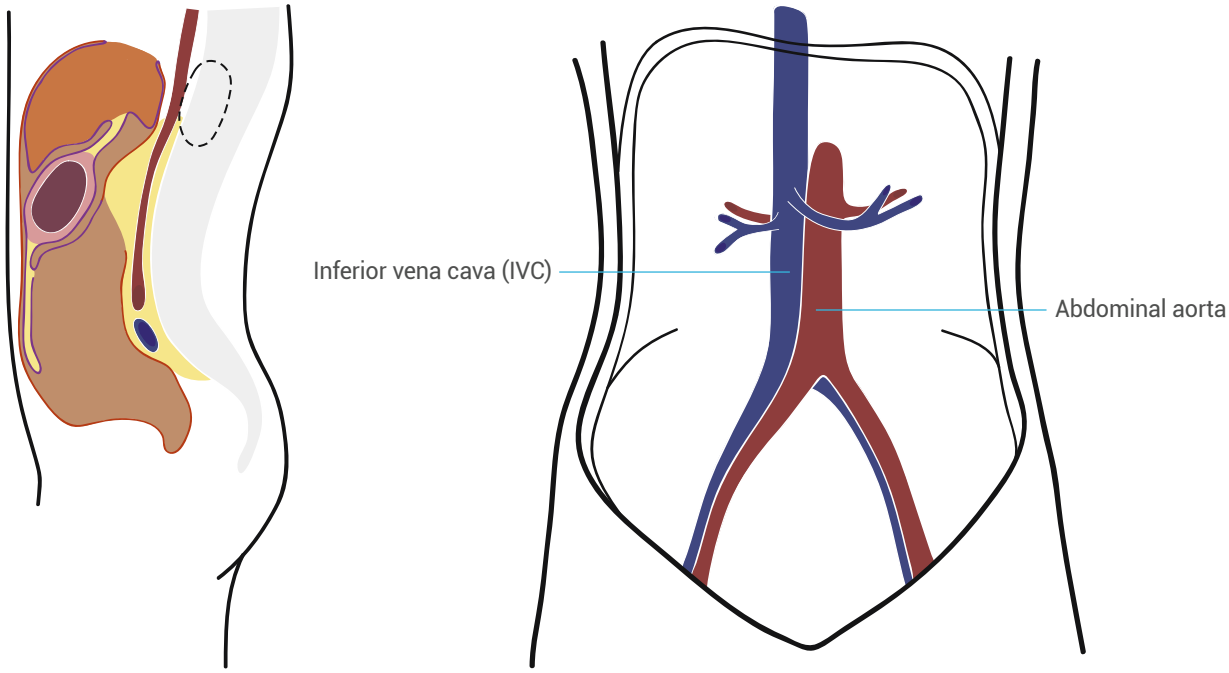
The Retroperitoneum

MASTERING ULTRASOUND ANATOMY

The retroperitoneum is a soft tissue cavity, located behind the peritoneal cavity, that contains fat tissue, blood vessels, lymphatic ducts, and nerve structures.
The retroperitoneum is bordered ventrally by the peritoneum and dorsally by the vertebral column, pelvis, and the dorsal abdominal wall (quadratus lumborum muscle and major psoas muscle).
The retroperitoneum is bordered cranially by the diaphragm. Communication with the mediastinum is possible through the aortic and caval hiatus.

Organ structures present in the retroperitoneum include

- The descending and lower transverse regions of the duodenum
- The pancreas
- The kidneys and ureter
- The ascending and descending colons



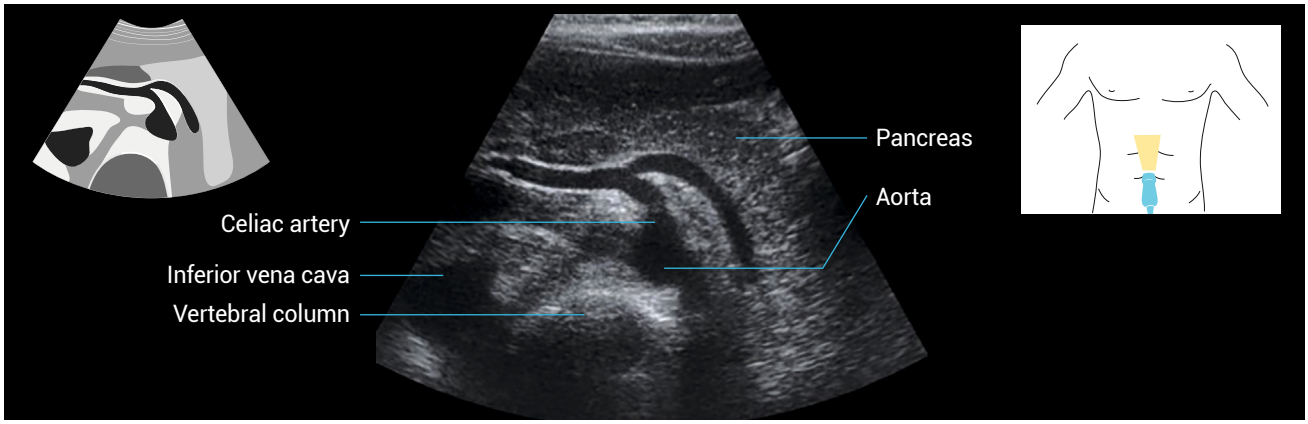
The major vessels present in the retroperitoneum are the inferior vena cava (IVC) and the abdominal aorta.

The Retroperitoneum

RECOGNIZING THE LANDMARKS

Upper abdomen–cross section

When performing ultrasound examination on the retroperitoneum it is important to follow the main vessel structures in cross section, caudally up to the aortic bifurcation.

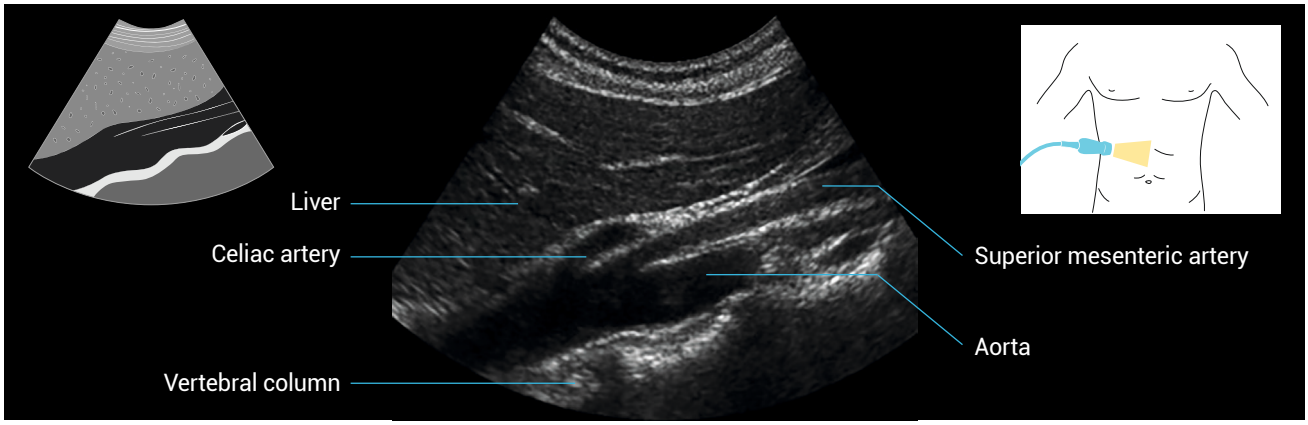


Aorta–long section

The celiac stem can be identified in cross section when the probe is placed over the patient's epigastrium. The branches leaving the celiac stem are the common hepatic artery and the splenic artery, which together form the swallow sign.

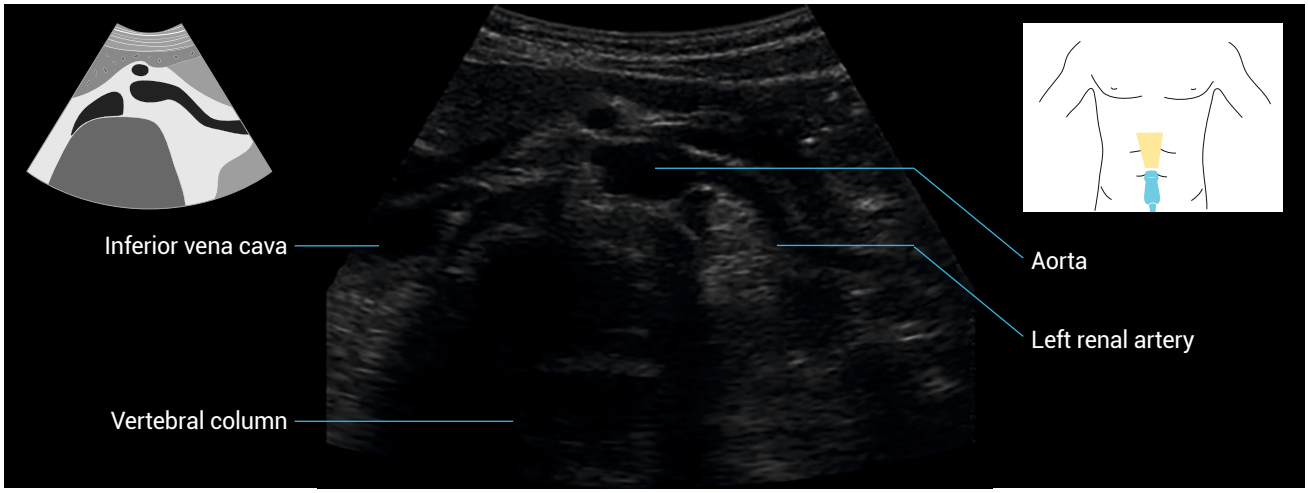
The body of the pancreas borders the aorta ventrally on the right.

The superior mesenteric artery leaves the aorta immediately caudal to the celiac stem. The image below is showing the aorta in long section in order to illustrate the proximity between the superior mesenteric artery and the aorta.

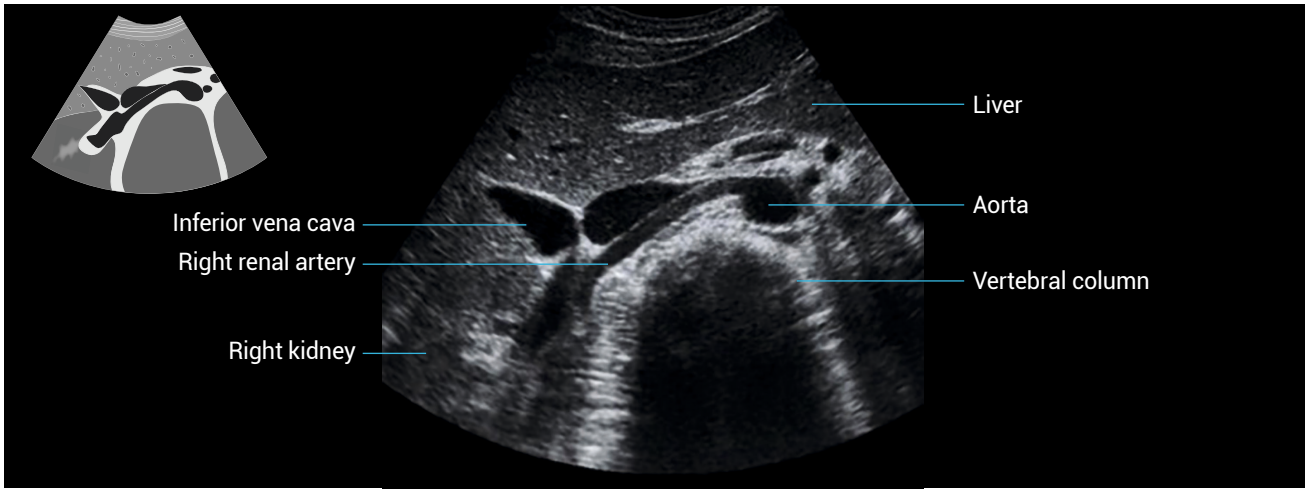


Aorta–cross section

In cross section, the left renal artery can be seen leaving the aorta.

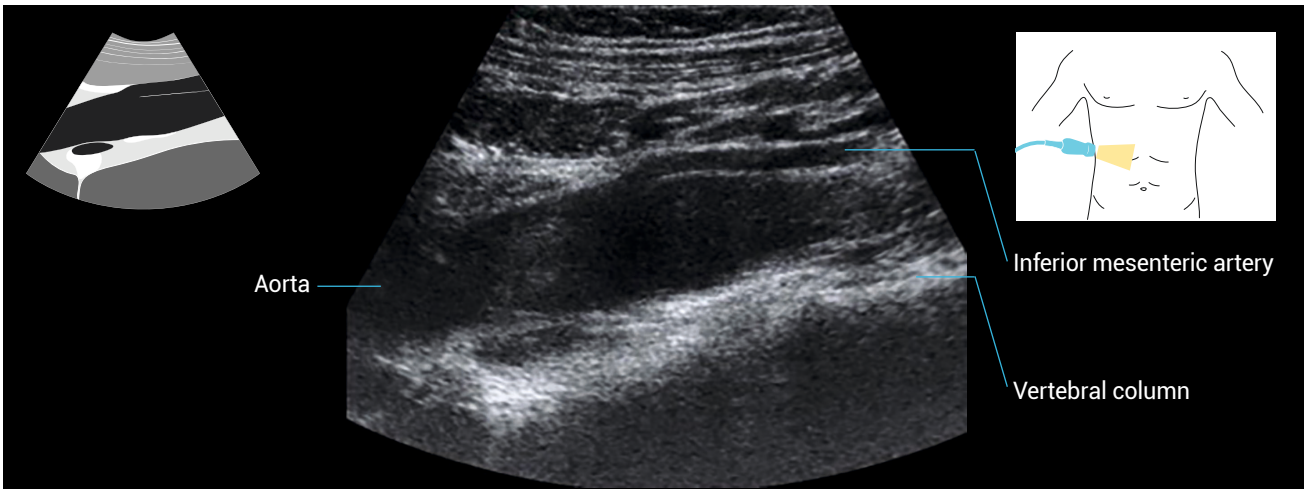


Due to the lower position of the right kidney in the abdomen, the right renal artery is the next main vessel branch leaving the aorta.



Abdomen–long section

The last main vessel leaving the aorta is the lower mesenteric artery, which is presented here in long section to demonstrate its relation to the aorta.



Inferior vena cava—long section

The inferior vena cava (IVC), or caval vein, has a much thinner wall than the aorta and shows less pulsatile movement.

It can be easily compressed to the point that it is no longer visible during ultrasound, so it is important not to apply too much pressure on the probe during examination.

Here you can see a lumbar artery running in cross section behind the IVC.

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HOW DO I DO IT?

Suggested algorithm for the ultrasound of the biliary system

1. Cross section. Position probe horizontally across middle of patient's torso, slowly follow main axis caudally until you reach pelvis

2. Long section. Position probe horizontally across middle of patient's torso

3. Landmarks: swallow sign (celiac artery with its branches), aorta and inferior vena cava (IVC) in cross section, aortic bifurcation, superior mesenteric artery in long section

Important:
Always follow the same sequence!

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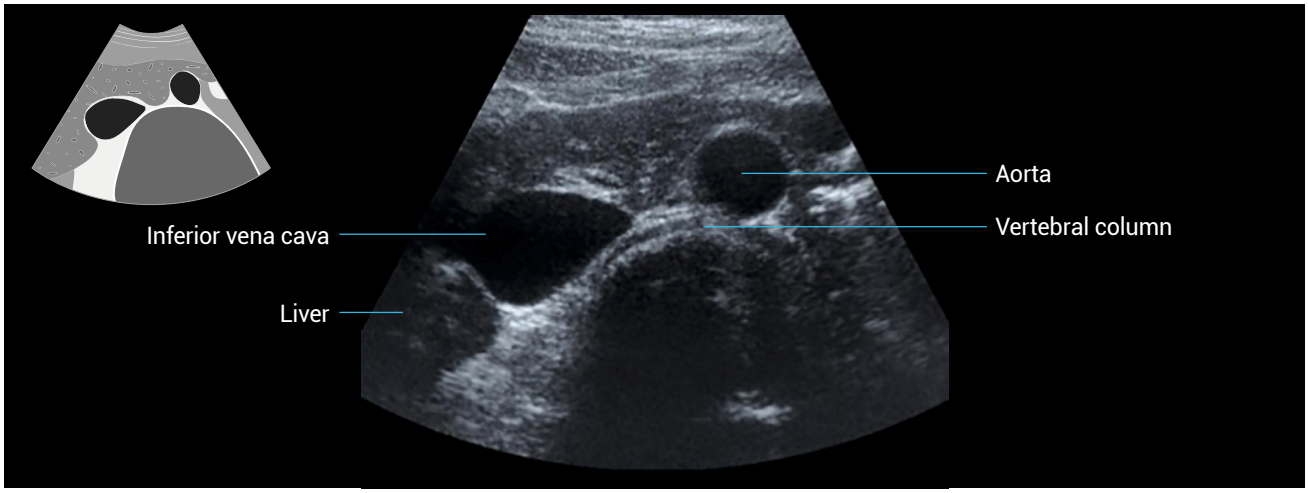
DIAGNOSING VASCULAR PATHOLOGIES

Normal

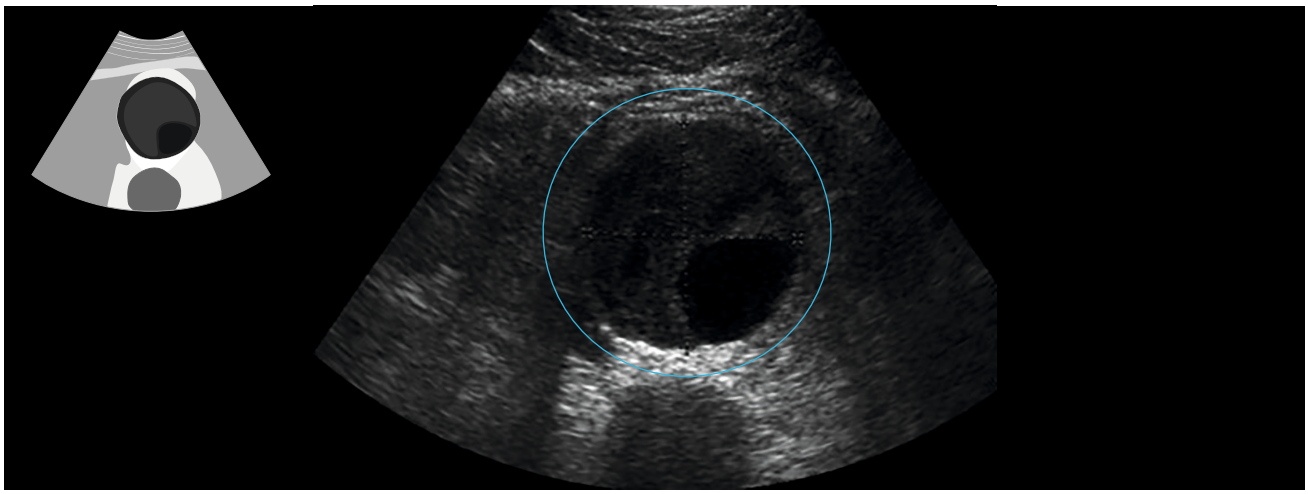
A normal abdominal aorta is round, has a diameter of up to 3 cm, and shows no plaques (see the image below.



Aortic aneurysm

Aortic aneurysm causes the diameter of the aorta to increase to more than 3 cm.

The image below shows an aortic aneurysm with a diameter of 5.5 cm.

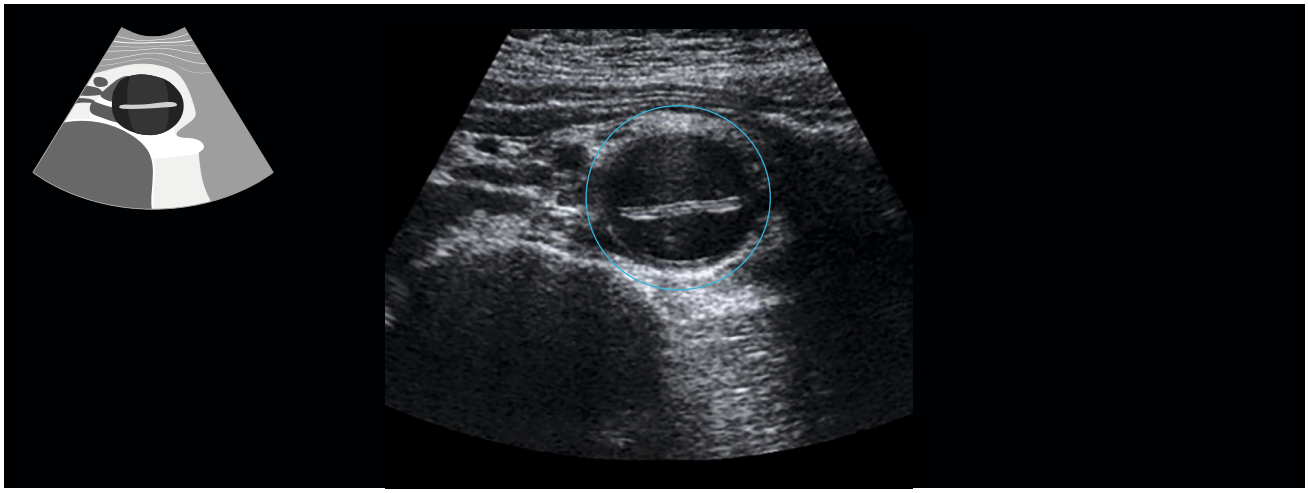


Aortic dissection

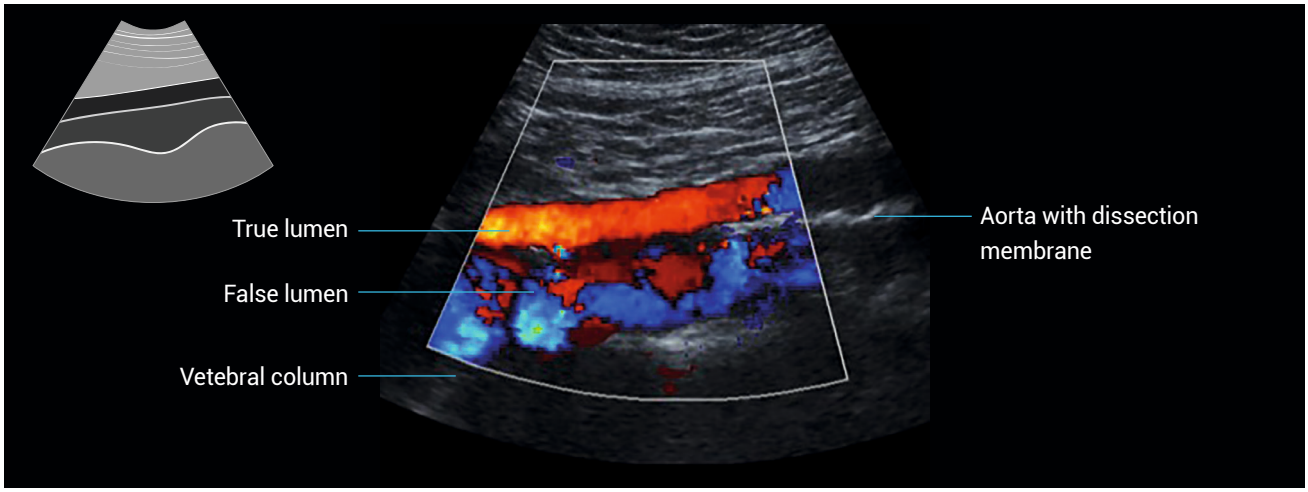
In the image below, the perfused lumen is visible as the echo-free region in the lower right quadrant of the aorta. The remainder of the lumen is filled with thrombotic material.

Aortic dissection is the most common form of acute aortic syndrome. It occurs when blood enters the medial layer of the aortic wall through a tear or penetrating ulcer in the intima and tracks along the media, forming a second blood-filled channel within the wall.

The image below illustrates a cross section through the abdominal aorta showing the transverse dissection membrane separating the true from the false lumen.

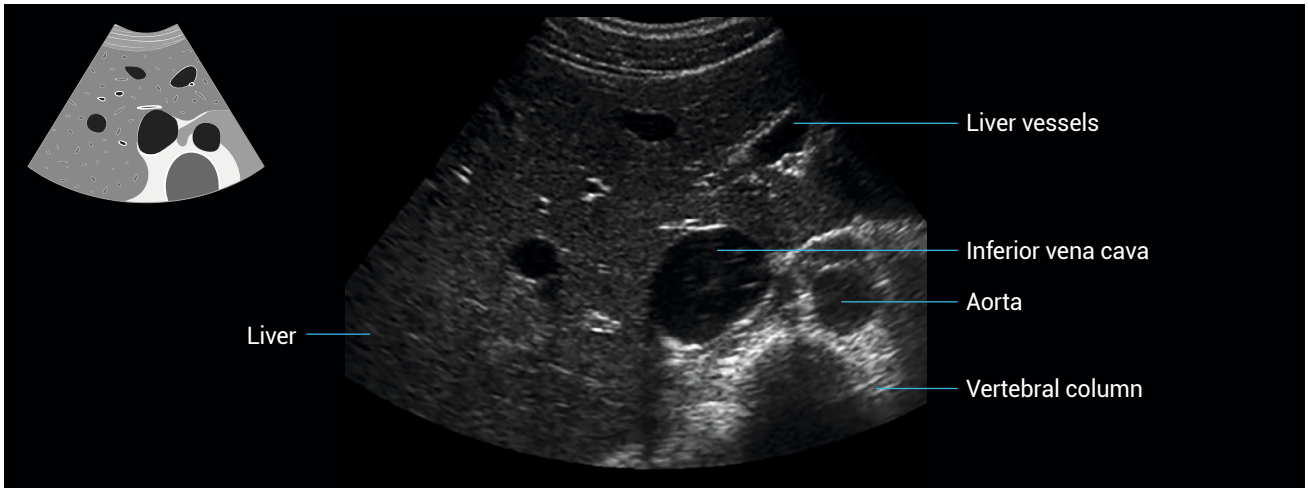


When examining an aortic dissection using color Doppler, the true lumen will always have a regular flow curve, while the false lumen will show high amounts of turbulence and possibly a reverse flow.



Inferior vena cava in heart failure

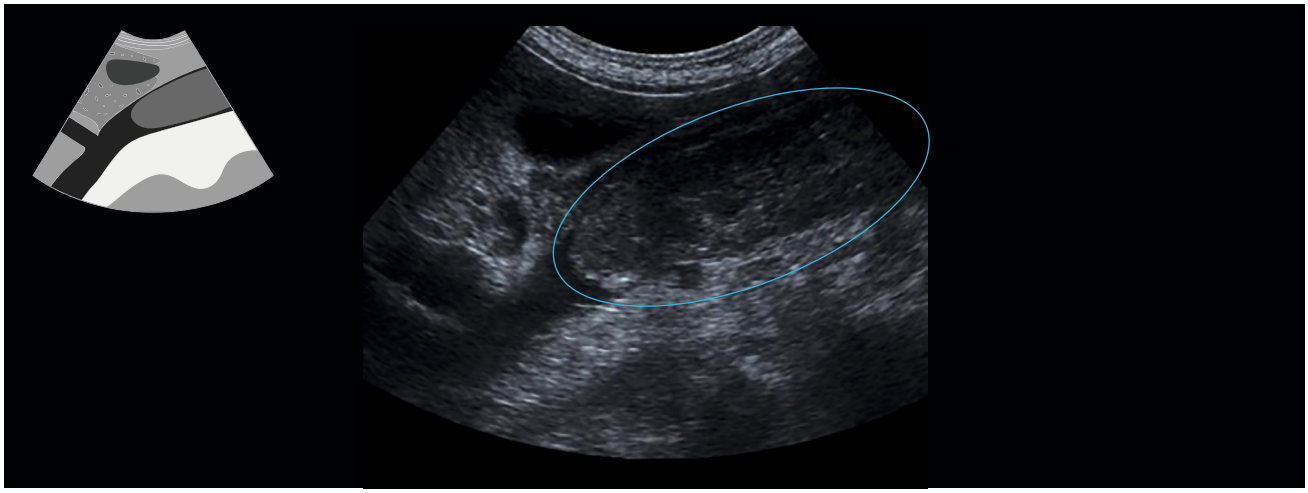
The inferior vena cava normally collapses during deep inspiration. In patients experiencing heart failure, the inferior vena cava will not collapse under inspiration and instead remains wide open.



Inferior vena cava thrombosis

Inferior vena caval (IVC) thrombosis is an essential diagnosis while evaluating any neoplastic lesion, or portal hypertension. It is also important to differentiate bland thrombus from tumor thrombus.

While any neoplastic lesion can cause IVC thrombosis, renal cell carcinoma is the most common malignancy to extend into the IVC. Other tumors that have a tendency for IVC thrombosis include hepatocellular carcinoma, adrenocortical cancer, and Wilms tumor, primary leiomyoma or leiomyosarcoma.



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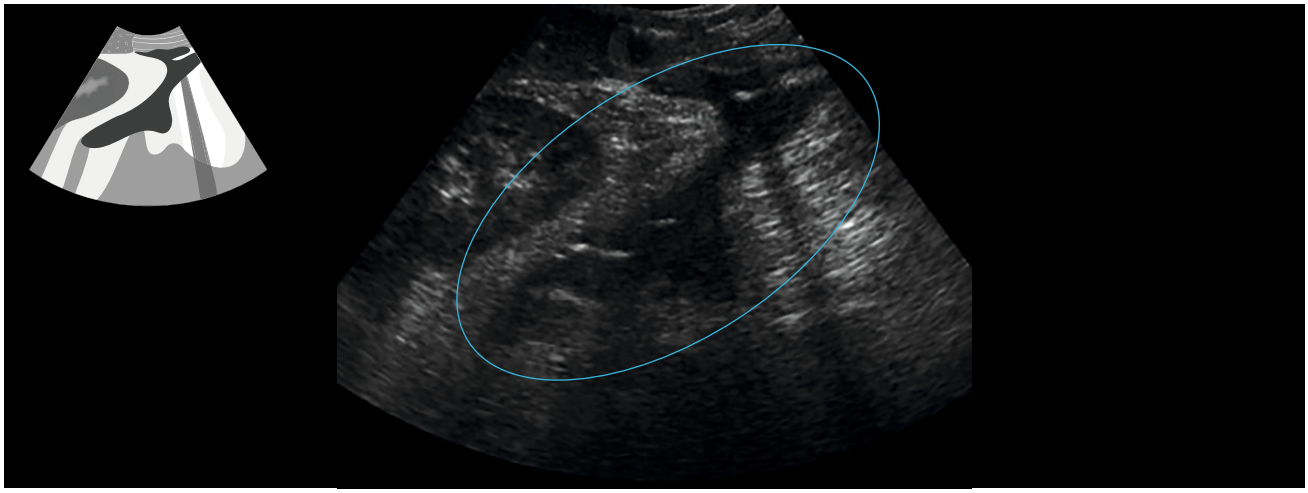
IDENTIFYING INFLAMMATION

Retroperitoneal fluid collection

Inflammation, especially in retroperitoneal organs like the pancreas or kidneys, can spread along the retroperitoneal tissue. Inflammation often leads to abscesses or circumscribed fluid collections that tend to be isoechoic, hypoechoic to anechoic in ultrasound. In the case illustrated below, the patient experienced a necrotizing pancreatitis several weeks previous and the retropertineal fluid collection can be seen lifting the perirenal fat shell upward. The fluid collection was drained transcutaneously under ultrasound guidance and the contents were confirmed to be pus.

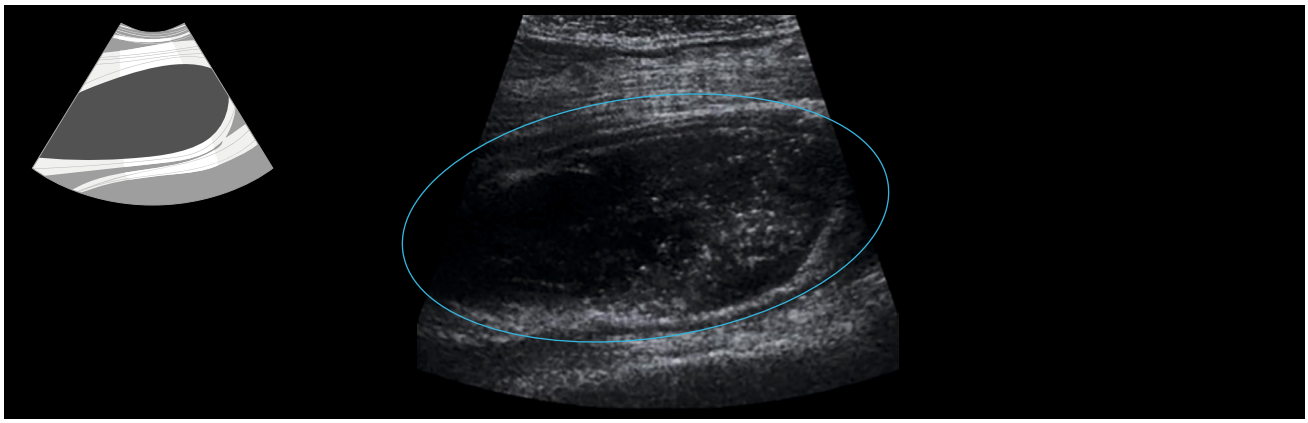


Psoas abscess

Primary psoas muscle abscess generally occurs as a result of hematogenous spread of an infectious process from an occult source within the body. Spread of infection from gastrointestinal disease (e.g., appendicitis, diverticulitis, Crohn‘s disease or perforated colon carcinoma) is the most common source of a secondary psoas muscle fluid collection.

Renal disease is the second most common source.

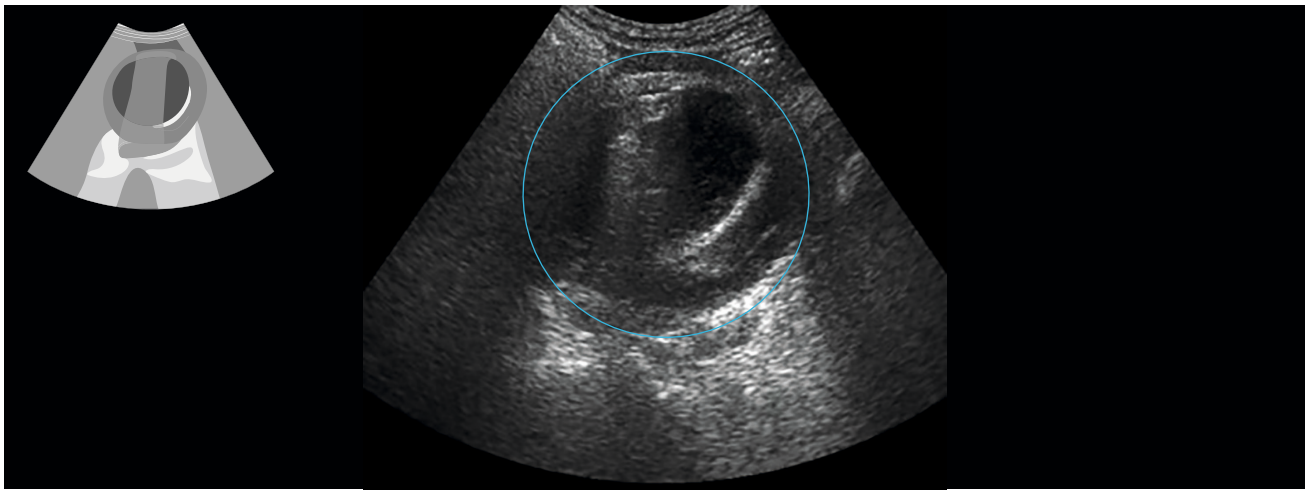
Psoas muscle abscesses may also occur as a result of a neighboring spondylodiscitis.



Infected psoas hematoma

Below is the ultrasound from a patient taking anticoagulative medication and with a known psoas hematoma after trauma, who presented with fever and malaise.

The hematoma had changed since the previous ultrasound (4 days ago—it was bigger and showed air bubbles—a typical sign of superinfection of the hematoma.



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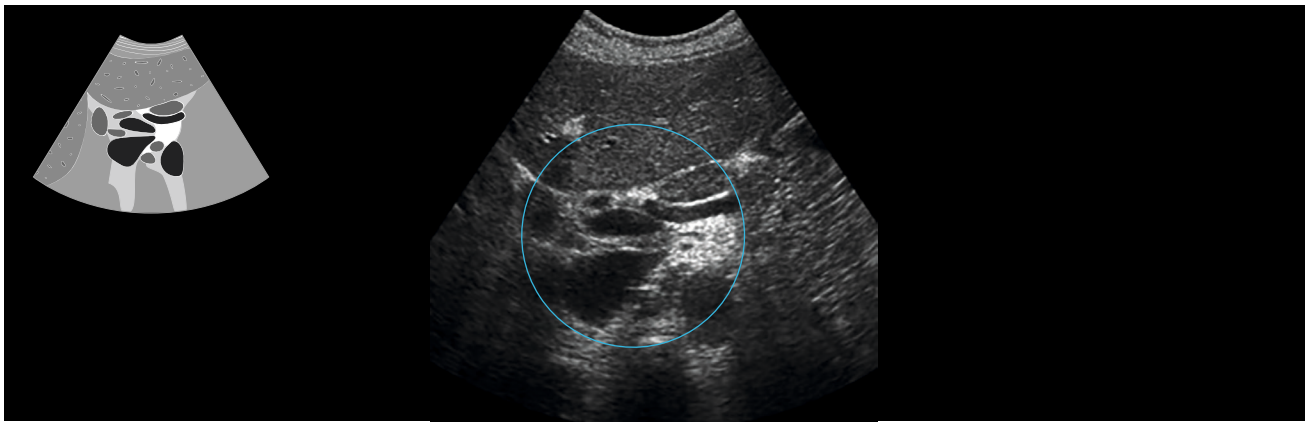
DIFFERENTIATING RETROPERITONEAL LYMPHADENOPATHY

Reactive lymph nodes

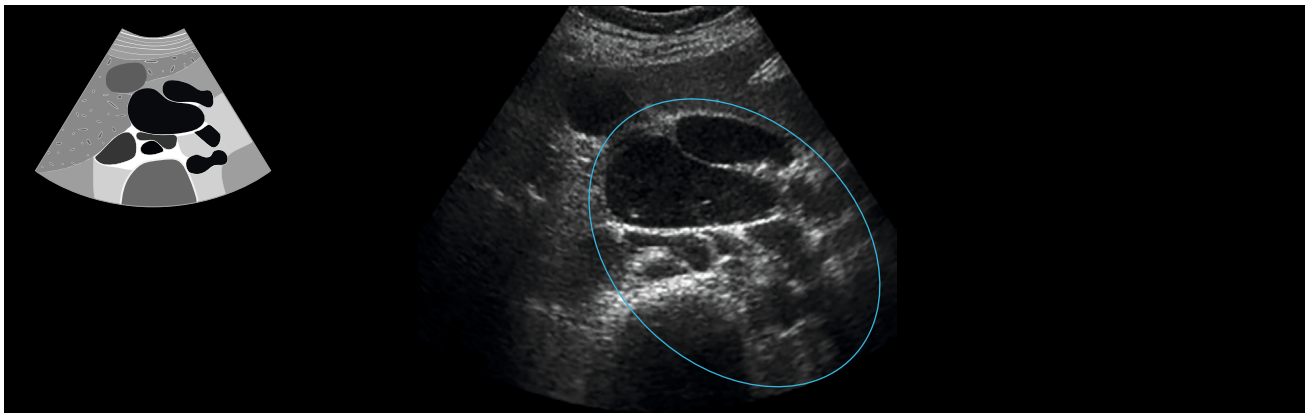
Reactive lymph nodes are the result of enlargement of the lymph nodes due to inflammation or the presence of a pathogen. In the case presented below, the lymph nodes are enlarged in the liver hilum as a result of hepatitis.

Note that the lymph nodes are not round but retain their oval appearance, keep a small slipper of fatty hilum and do not grow larger than 1 cm in short axis.



Lymphoma

Pathological lymph nodes in the retroperitoneum, seen around the great vessel space in the image below, are normally hypoechoic , greater than 1 cm in width, and can form whole bulks. Lymphomas typically contain enlarged lymph nodes that are soft, since they tend to contain predominantly lymphatic tissue and have less connective tissue or calcifying components. The vessels normally are not compressed even by large lymph bulks.



Metastatic lymph node

Metastatic lymph nodes also tend to be isoechoic to hypoechoic, but normally show destroyed architecture. Since the metastases contain more connective tissue than normal lymph nodes, they tend to be harder and can compress or disturb neighboring structures.

Urogenital (renal, ovary, testicle, bladder) and rectal carcinomas are the most common primary tumors to metastasize to the lymph nodes.