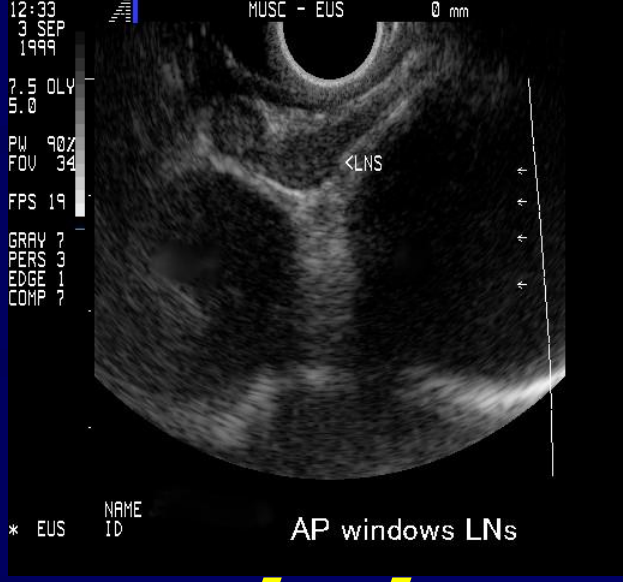


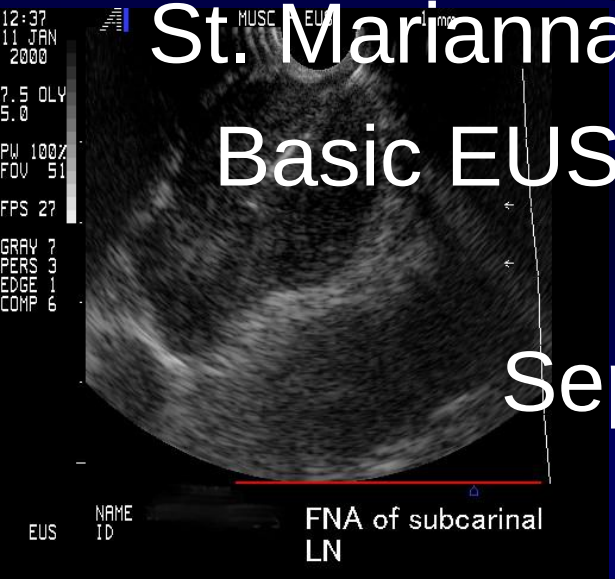
Linear EUS
What to see and how to do it

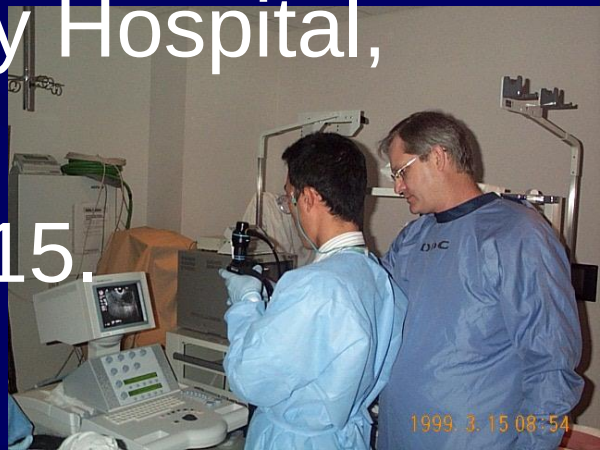
Koji Matsuda MD, PhD

St. Marianna University School of Medicine

Basic EUS course at Cho Ray Hospital,
Cho Ray, Vietnam

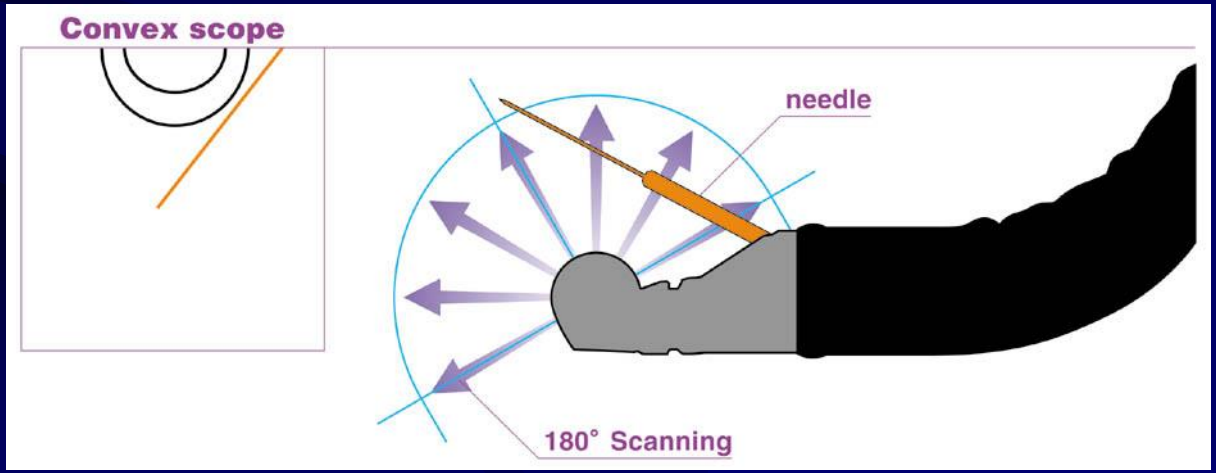
September 18-19, 2015.





Linear EUS Scope

- GF-UC260
  - (Working channel: 2.8mm)
- GF-UCT260
  - (Working channel: 3.7mm)



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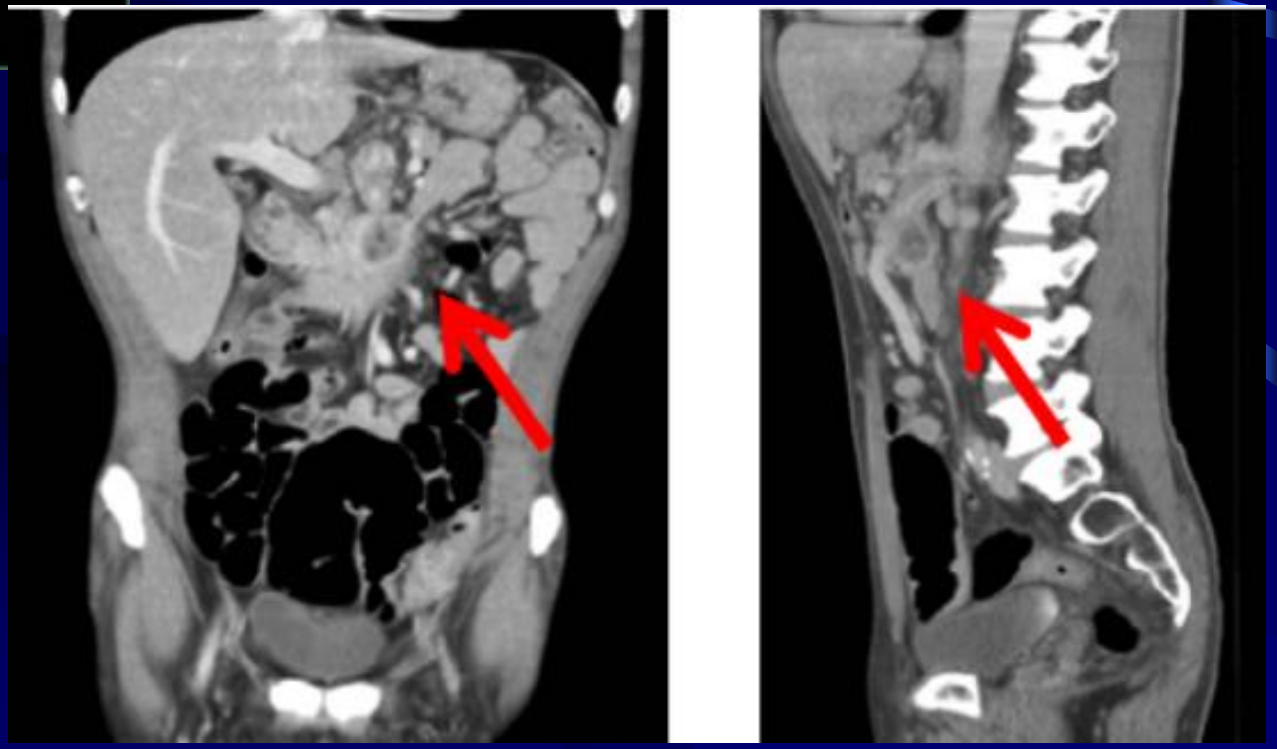
- Similar to the reconstructed images from CT scan



Bible for CLA scope

Digestive Endoscopy (2007) **19** (Suppl. 1), S180–S205 doi:10.1111/j.1443-1661.2007.00742.x

SPECIAL REPORT

STANDARD IMAGING TECHNIQUES OF ENDOSCOPIC ULTRASOUND-GUIDED FINE-NEEDLE ASPIRATION USING A CURVED LINEAR ARRAY ECHOENDOSCOPE

EUS-FNA Stand[illegible]tee
Kenji Yamao,[1] Atsushi Irisawa,[2] Hiroyuki Inoue,[3] Koji Matsuda,[4] Mitsuhiro Kida,[5] Shomei Ryozawa,[6] Yoshiki Hirooka[7] and Teruo Kozu[8]

[1]*Aichi Cancer Center Hospital,* [2]*Fukushima Medical University,* [3]*Mie University,* [4]*Jikei University Aoto Hospital,* [5]*Kitasato University East Hospital,* [6]*Yamaguchi University,* [7]*Nagoya University,* [8]*Chiba University*

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Through esophagus

Scanning Position	Landmarks	Tips
Esophagus	Descending aorta Inferior vena cava (IVC) Azygos vein Right atrium, left atrium & left ventricle Ascending aorta Pulmonary artery Tracheal bifurcation Aortic arch	Insert the scope into the stomach past the EG junction ,and visualize the liver, hepatic veins and IVC, and then observe the entire image while visualizing each of the indices.)

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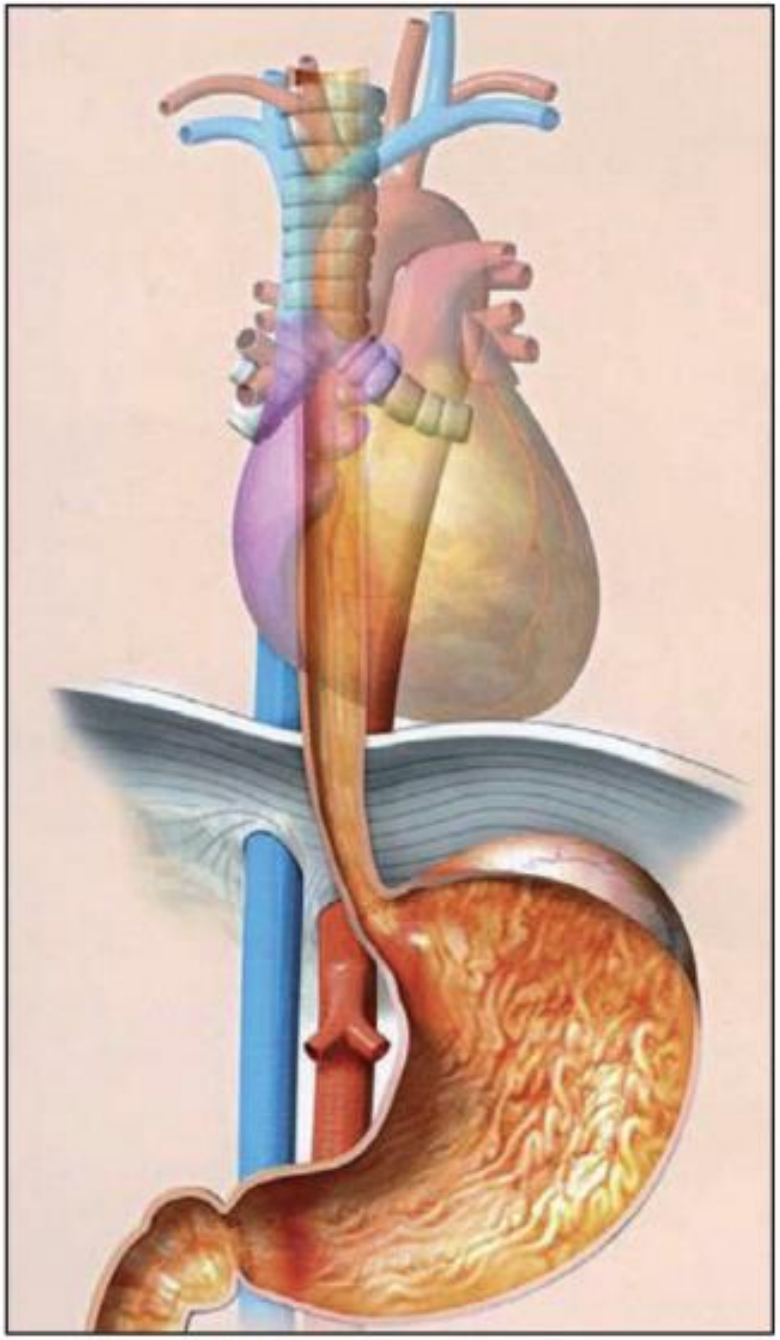
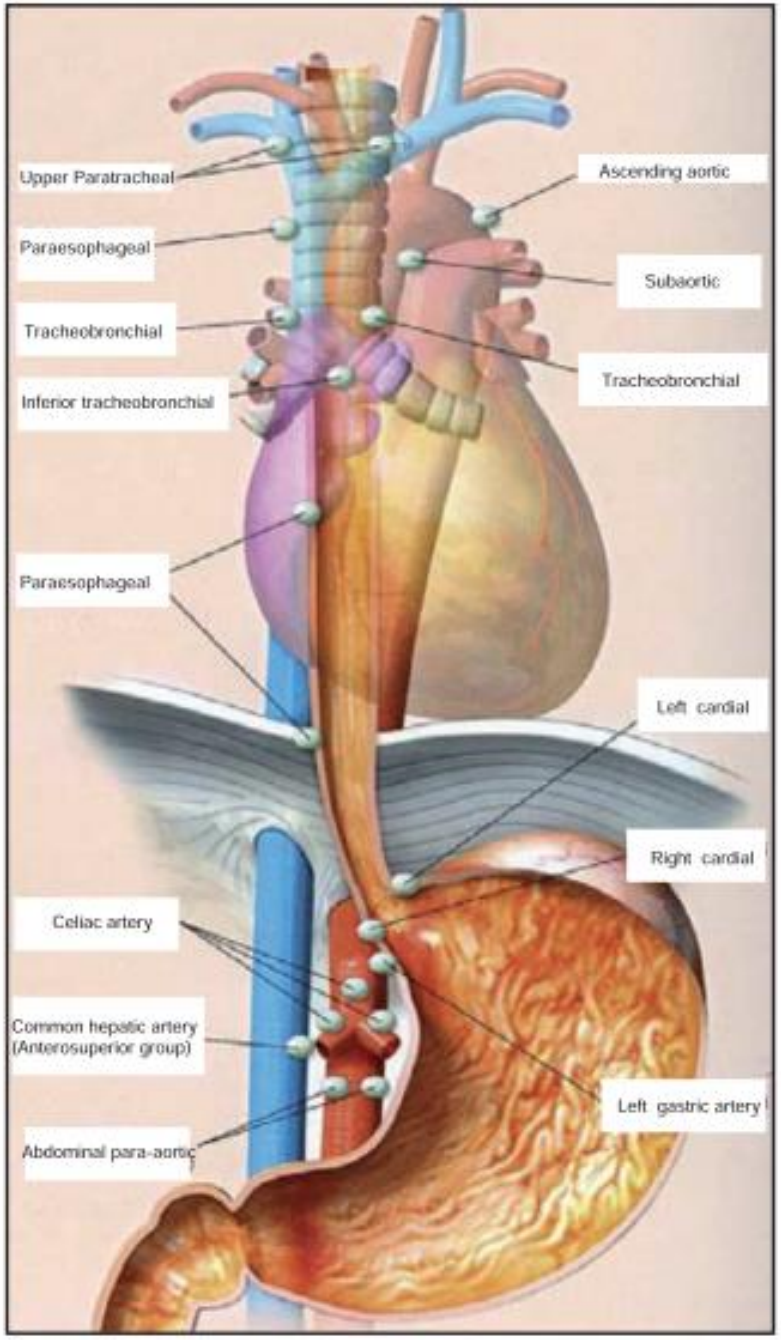
■ Esophagus





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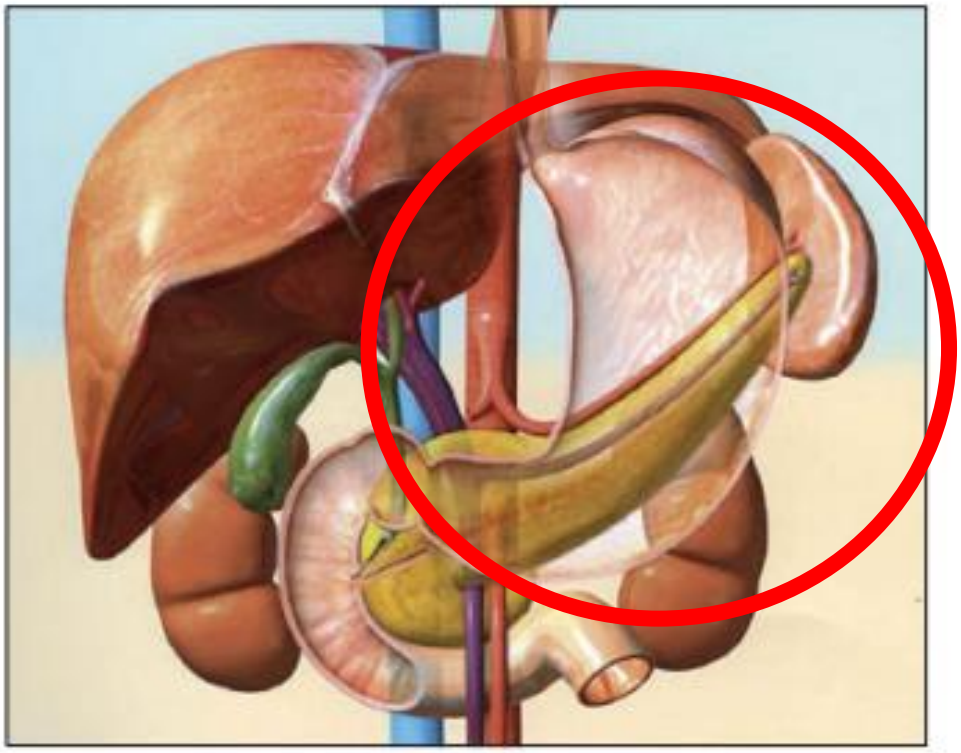
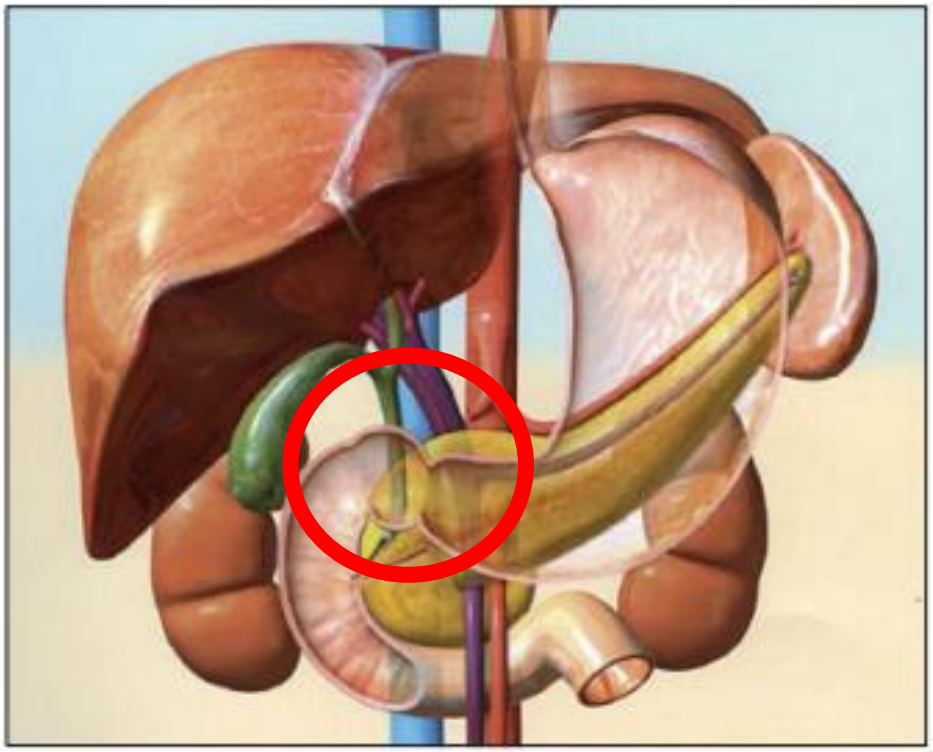
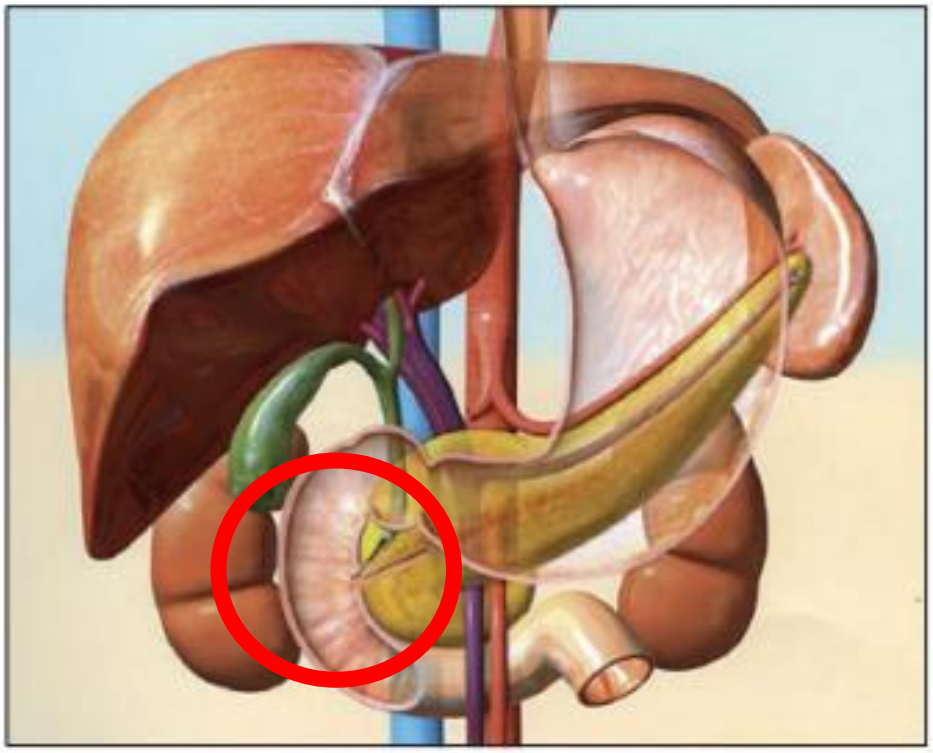
Scanning Position	Landmarks	Tips
Stomach	Hepatic veins Abdominal aorta Celiac artery Splenic artery/vein Superior mesenteric artery/vein Portal vein Liver Pancreas Left kidney Spleen Left adrenal gland Bile duct Gallbladder	Insert the scope till the EG junction. After recognizing the hepatic veins, observe the entire image while imaging each of the indices. Alternately, observe the duodenal region first and then observe other regions while withdrawing the scope toward the oral side.



Scanning Position	Landmarks	Tips
Duodenal bulb	Portal vein Superior mesenteric artery/vein Splenic vein IVC Abdominal aorta Gallbladder Bile duct Pancreatic head Pancreatic body	Insert the scope as far as the duodenal bulb and observe using the push technique.



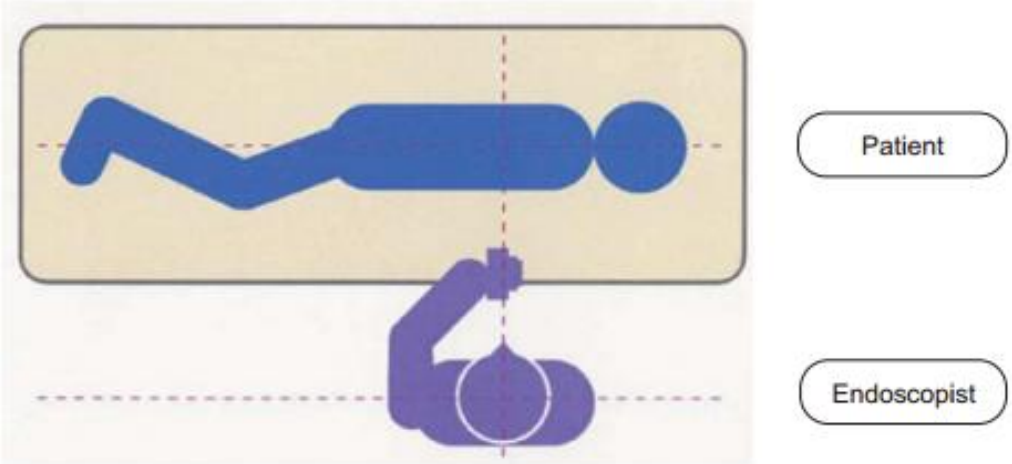
Scanning Position	Landmarks	Tips
Descending part of duodenum	Abdominal aorta IVC Superior mesenteric artery/vein Pancreatic head Papilla of Vater Bile duct Right kidney	Straighten the scope in the same way as ERCP (pull technique), and then observe while withdrawing from the distal to proximal duodenum.



Positioning is critical!

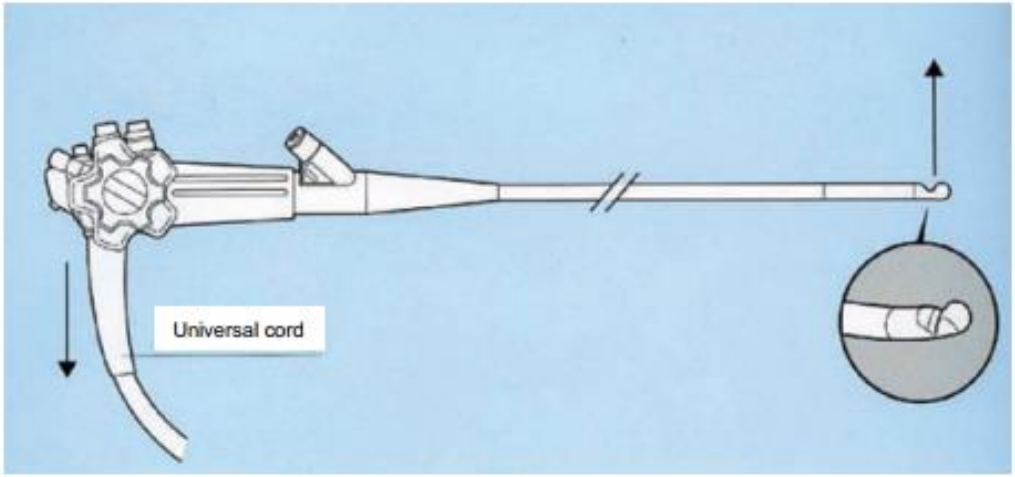
■ Positioning of the endoscopist and orientation of the echoendoscope

The orientation of the images in this handbook are with the endoscopist facing the patient, and with the scope handle oriented orthogonally to the patient's body.



■ Rotating the curved linear array echoendoscope

To correctly identify the position relationships of the surrounding organs, observation should generally be performed while the scope is straightened. In the stretched condition, the transducer is oriented towards the direction opposite to the universal cord.



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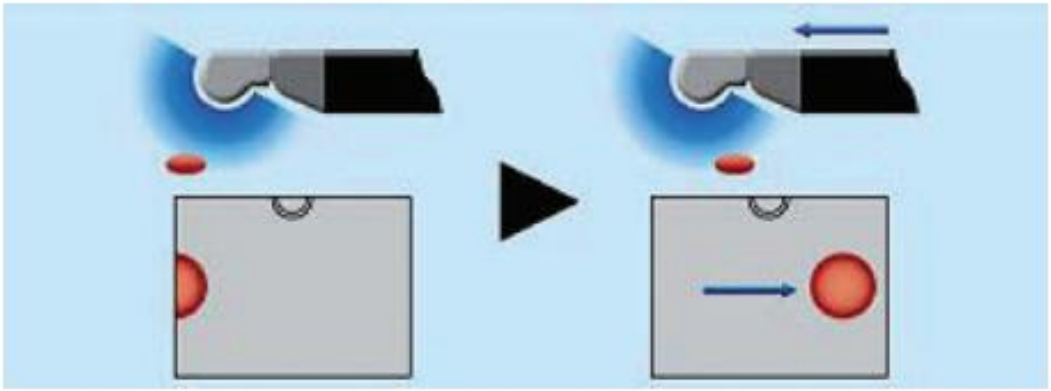
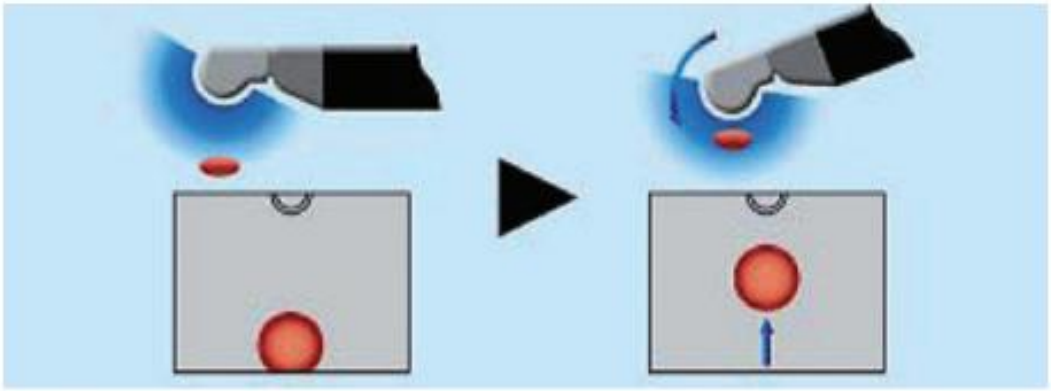
Typical scope manipulation for CLA scope

■ Optimizing position for target puncture

When the scope is advanced toward the left, the puncture target in the ultrasound image moves toward the right.



The transducer is attached at the scope's distal end so that the transducer orients toward the upward angulation direction of the scope (i.e. on the opposite side to the universal cord). When the scope is angulated upward, the transducer approaches the puncture target and the target in the ultrasound image moves upward.



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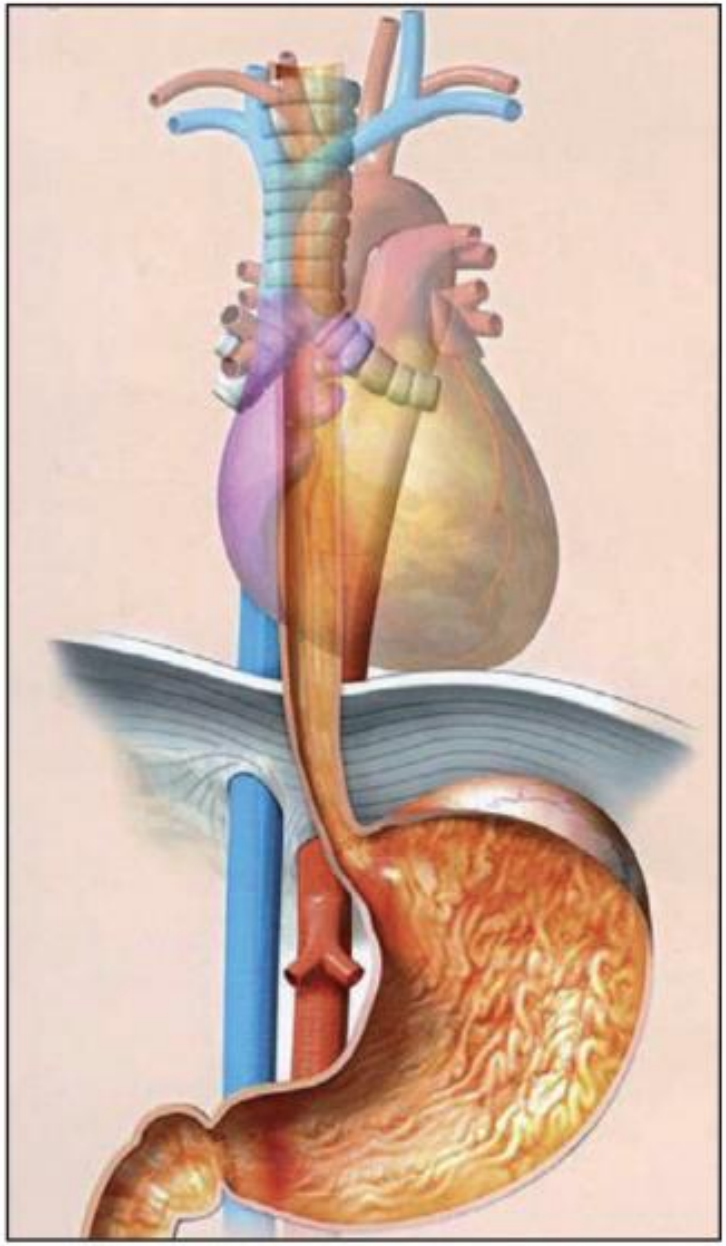
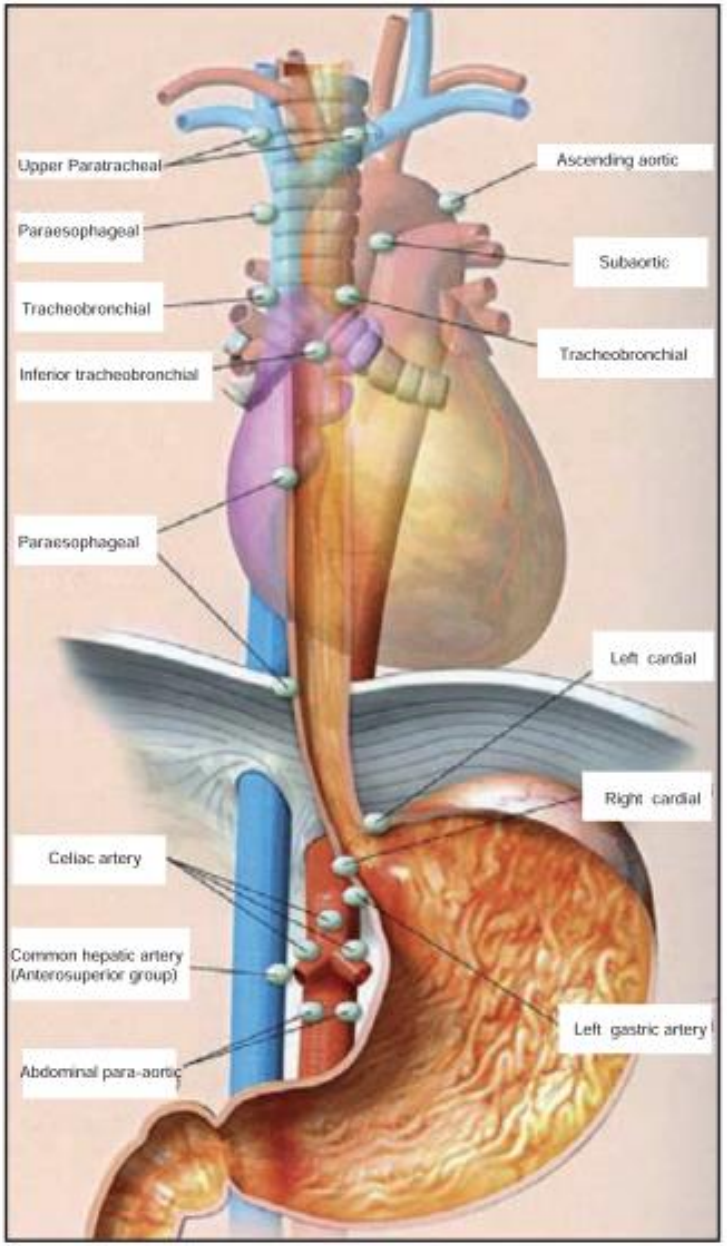
■ Esophagus





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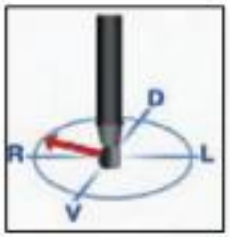
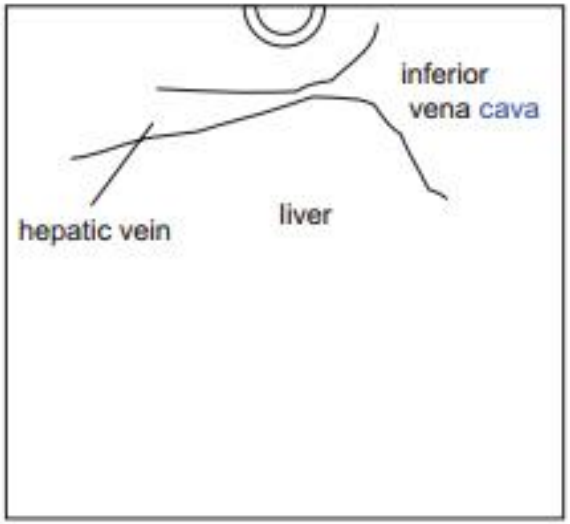
Through esophagus Step1: Find liver

■Step 1





When the scope is inserted into the stomach past the EG junction with the controls free, the left lobe of the liver is visible on the screen below the scope. Now rotate the scope clockwise to visualize the hepatic vein and the IVC.

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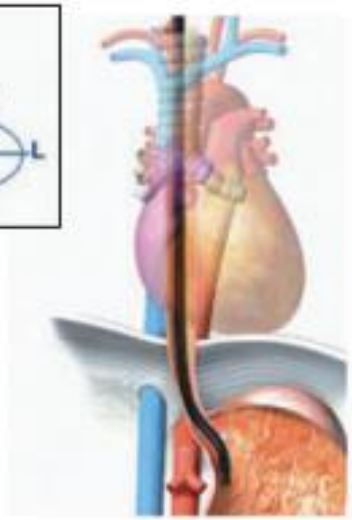
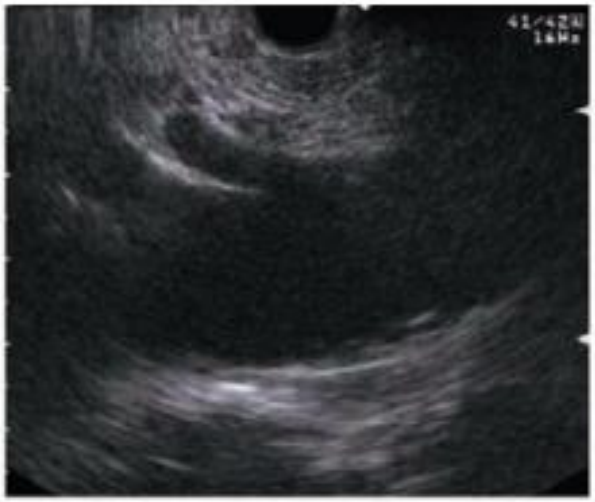
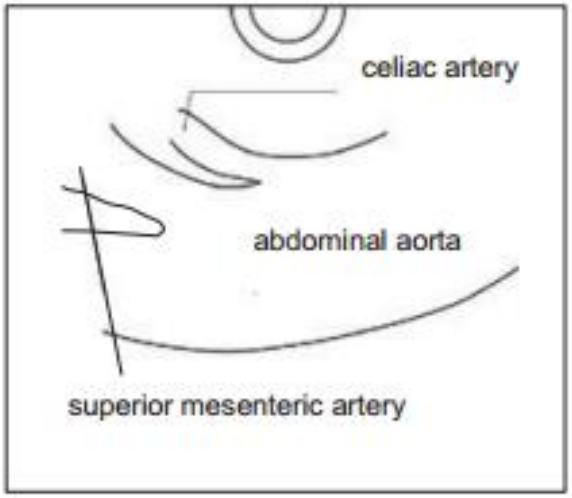
Through esophagus Step2: Find abdominal aorta

■Step 2







After observing the liver, rotate the scope clockwise to observe the abdominal aorta. Then advance the scope slightly until the celiac artery bifurcation and superior mesenteric artery are recognized. Observe the lymph nodes around the celiac artery from this position.

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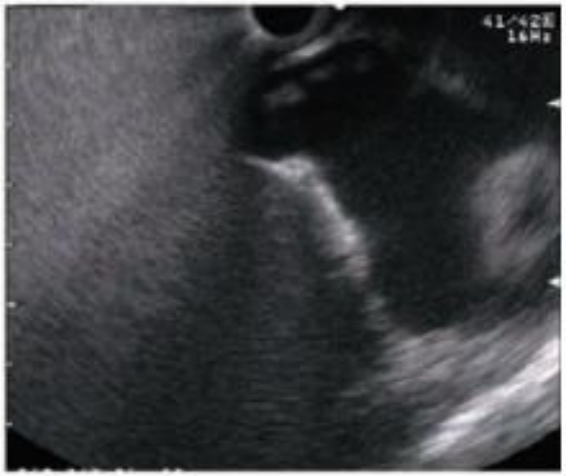
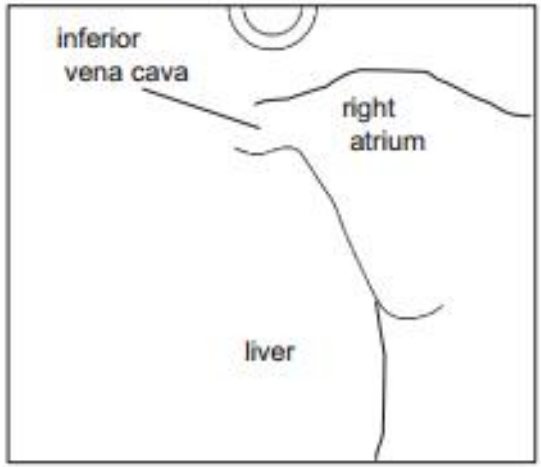
Through esophagus Step3: Pull back & find Rt. Atrium

■Step 3





After observing the IVC, withdraw the scope to observe the right atrium.

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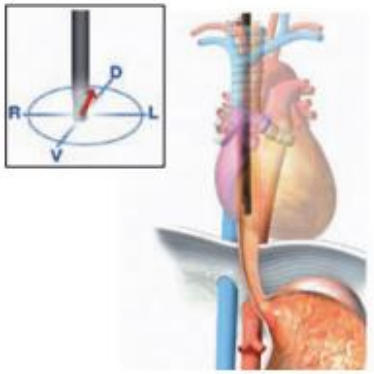
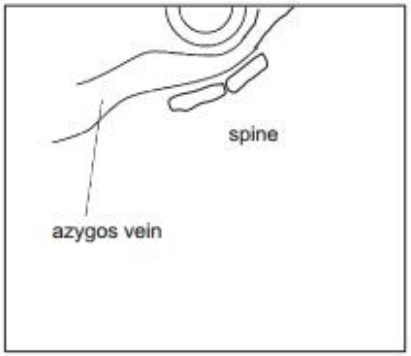
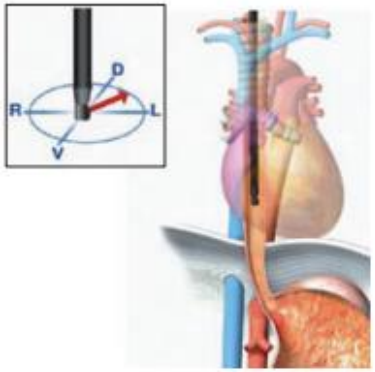
Through esophagus Step4: Torque right & find AV & Ao

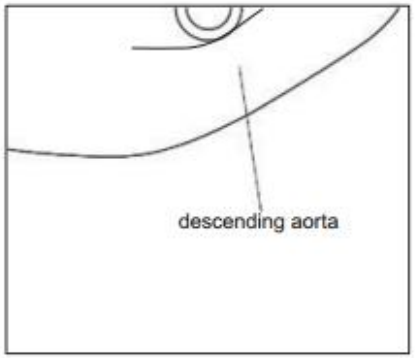
■Step 4





Rotate the scope clockwise to observe the entire surroundings of the esophagus. Then withdraw the scope slightly until the azygos vein is identified. Trace the azygos vein in both longitudinal directions toward the caudal and oral sides, and look for any adjacent lymph nodes.





Rotate the scope further clockwise to observe the descending aorta also. Trace the descending aorta longitudinally towards both the caudal and oral directions, and look for any adjacent lymph nodes.

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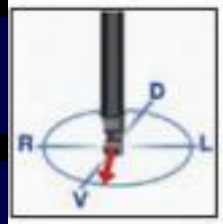
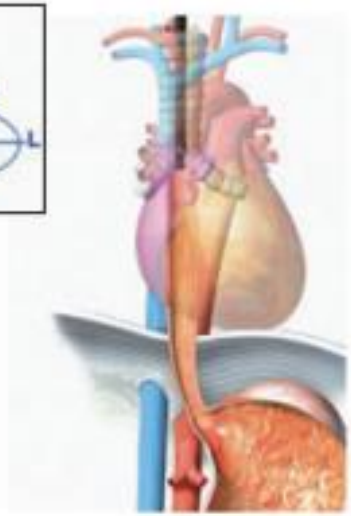
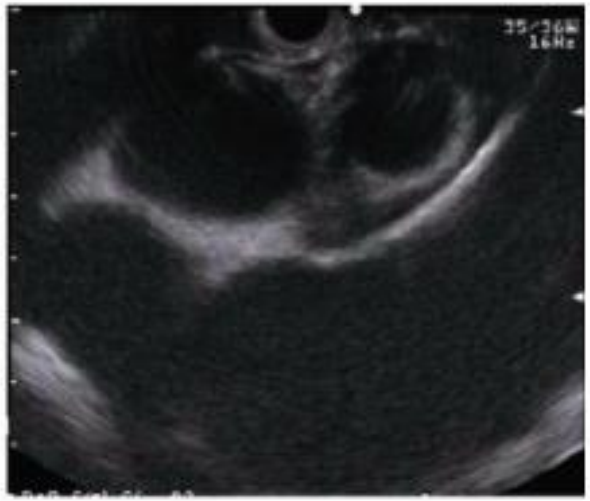
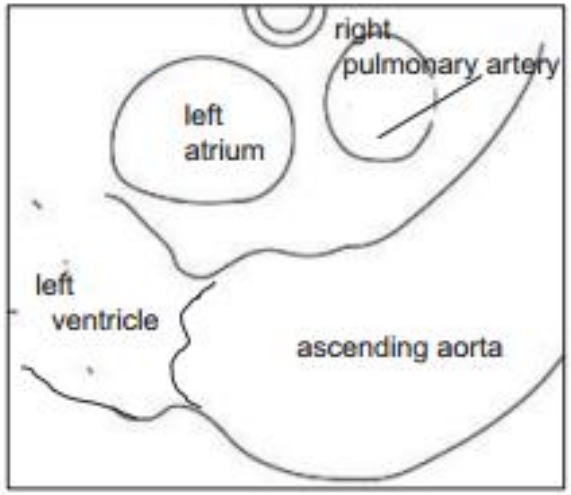
Through esophagus Step5: Torque left & find Rt. PA

■Step 5









Rotate the scope counterclockwise to return to the positioning in Step 3, and withdraw the scope while rotating it further counterclockwise to visualize the left atrium, left ventricle, ascending aorta and right pulmonary artery.

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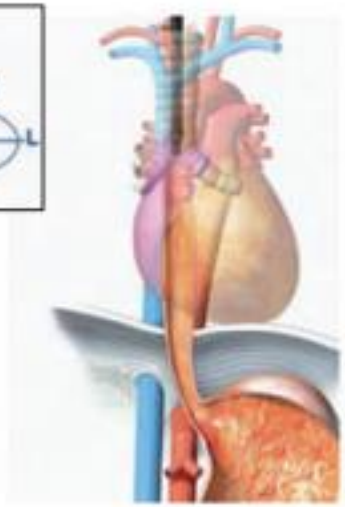
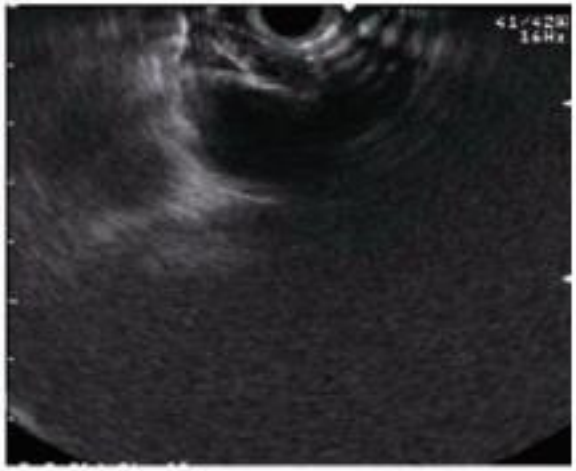
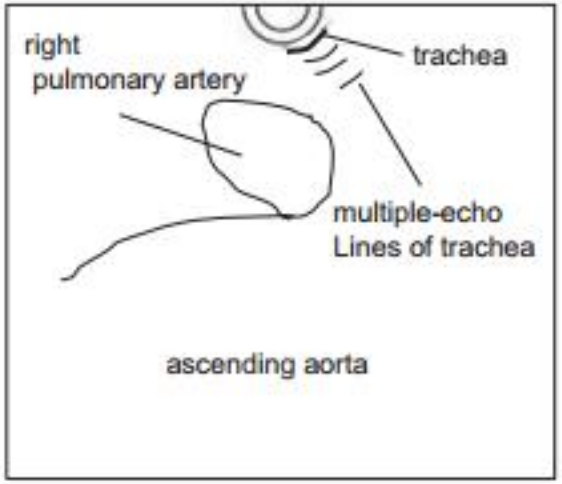
Through esophagus Step6: Pull back & find trachea

■Step 6







While watching the right pulmonary artery, withdraw the scope while rotating it slightly counterclockwise to visualize the trachea or main bronchi. The point towards the oral side (right in the image) where the multiple-echo lines end, is the tracheal bifurcation into the left and right main bronchi. If imaging of this point is difficult, trace the multiple-echo lines from the oral side to the point where these are interrupted.

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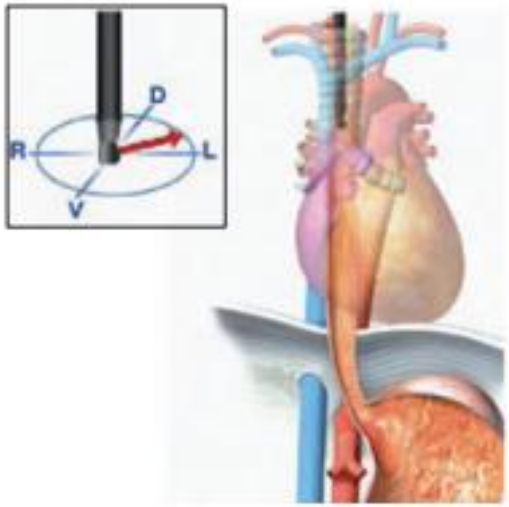
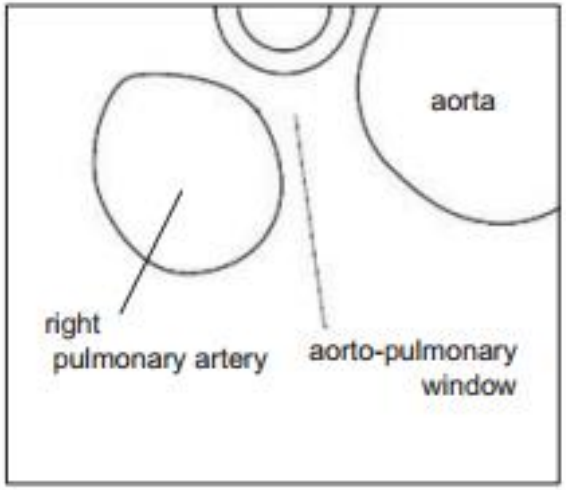
Through esophagus Step7: Torque right & find AP window

■Step 7





Visualize the right pulmonary artery again, and withdraw the scope while rotating it counterclockwise to visualize the right pulmonary artery on the left side in the image and the cross-section of the aortic arch on the right side. The region between the two blood vessels is the aorto-pulmonary window (AP window).

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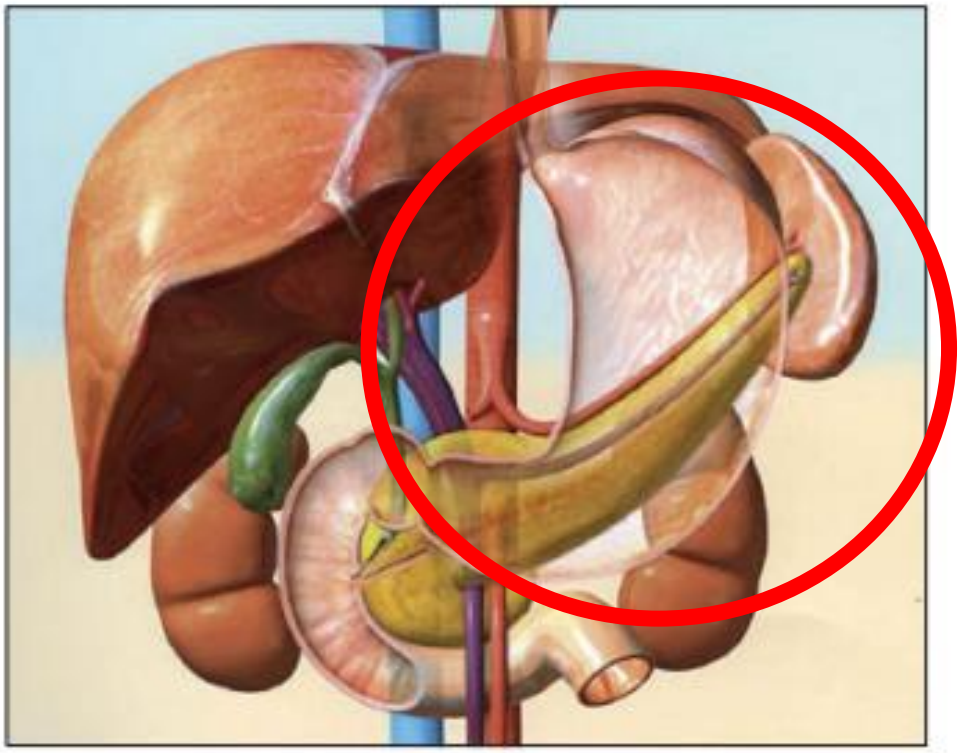
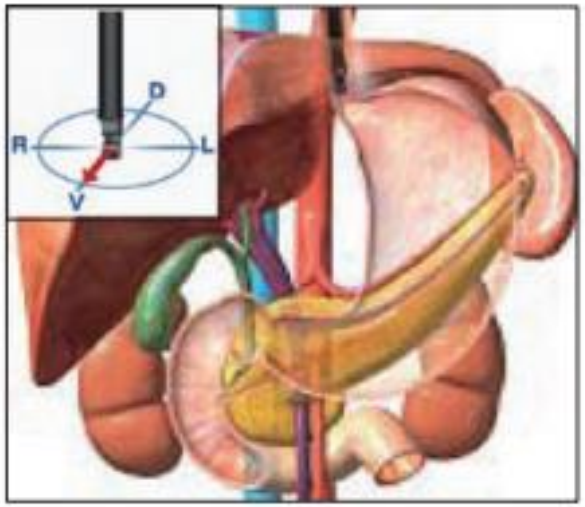
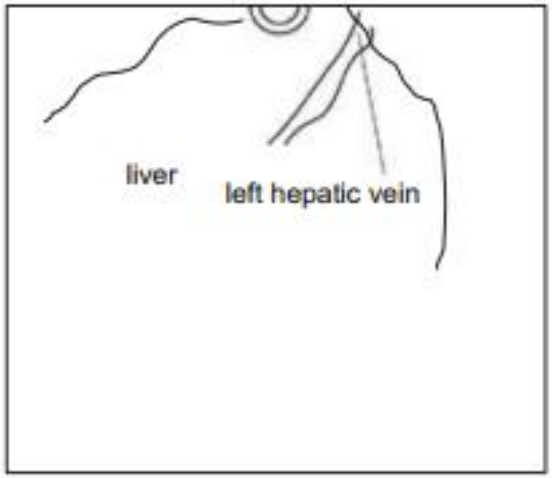
Scanning Position	Landmarks	Tips
Stomach	Hepatic veins Abdominal aorta Celiac artery Splenic artery/vein Superior mesenteric artery/vein Portal vein Liver Pancreas Left kidney Spleen Left adrenal gland Bile duct Gallbladder	Insert the scope till the EG junction. After recognizing the hepatic veins, observe the entire image while imaging each of the indices. Alternately, observe the duodenal region first and then observe other regions while withdrawing the scope toward the oral side.



Through Stomach Step1: Find liver

■Step 1





With the patient lying in the left lateral position, the (outer region of the) left lobe of the liver is imaged after the scope has passed the diaphragm. The transducer is now oriented anteriorly toward the abdominal wall of the patient. The left hepatic vein is also observed from this position.

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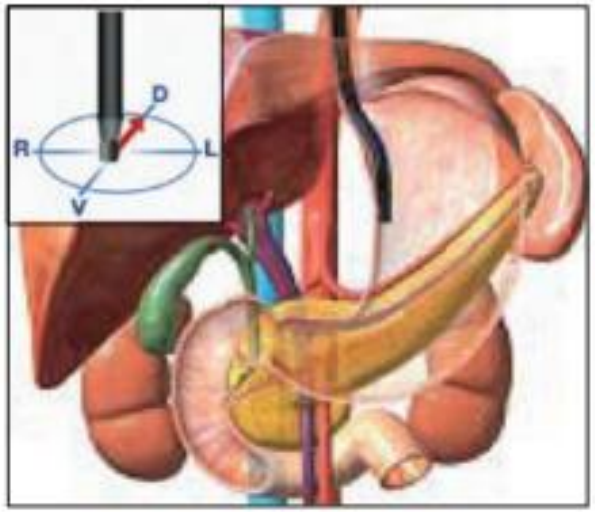
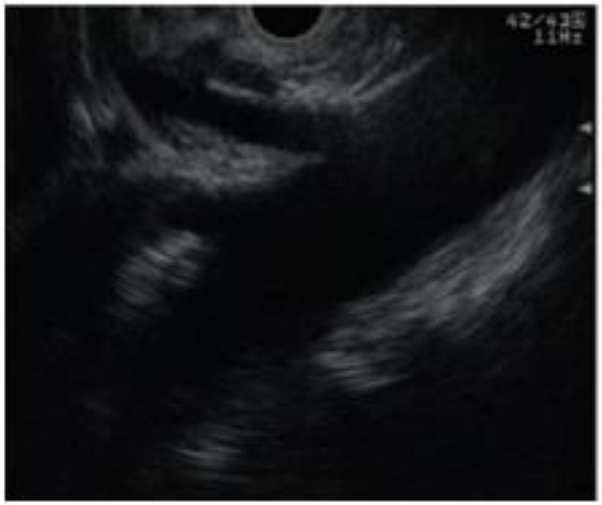
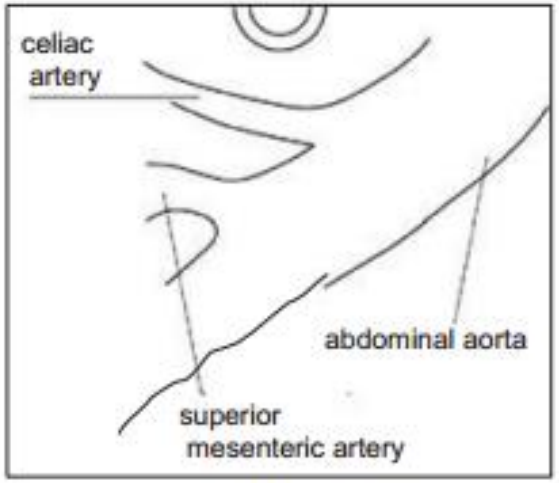
Through Stomach Step2: Torque 180 deg. & find Aorta

■Step 2







Rotate the scope clockwise to visualize the abdominal aorta. When the scope is advanced caudally from this position along the abdominal aorta, the celiac artery and superior mesenteric artery are imaged. Note that the celiac artery and superior mesenteric artery are not always imaged simultaneously. The celiac artery is usually easier to image. It is therefore recommended to visualize the celiac artery first and then rotate the scope slightly clockwise or counterclockwise to identify the superior mesenteric artery.

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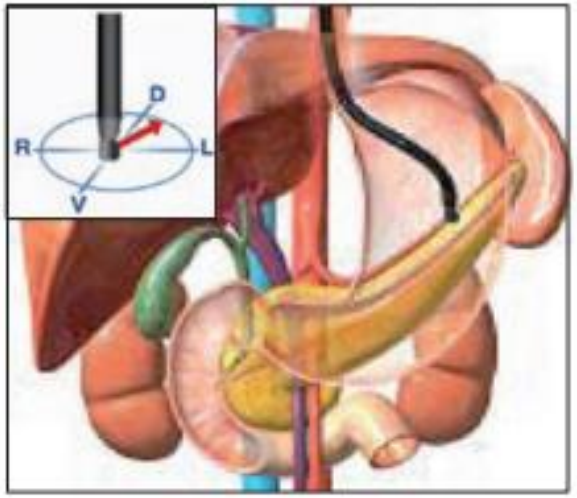
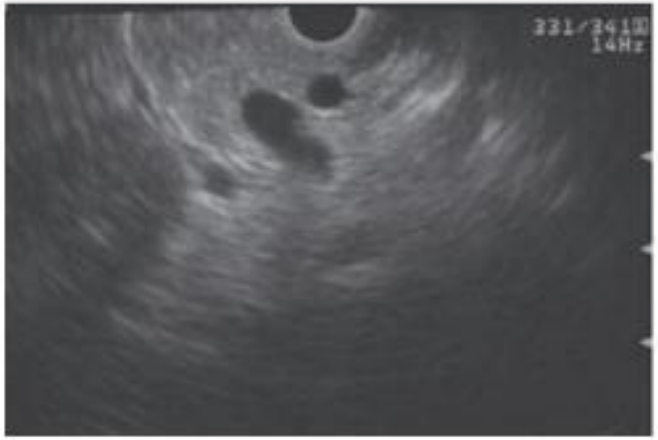
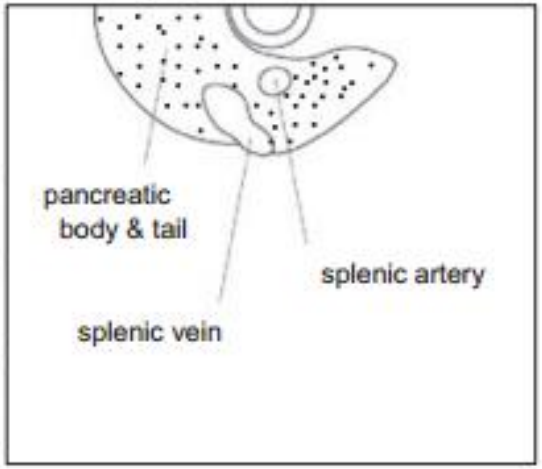
Through Stomach Step3: Push in & find pancreas

■Step 3







Advance the scope slightly and rotate it clockwise to visualize the pancreatic body and tail. In general, the splenic artery is imaged nearer and splenic vein farther from the transducer. The splenic artery and vein can be discriminated by means of color and pulse Doppler.

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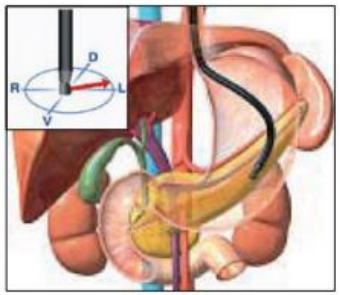
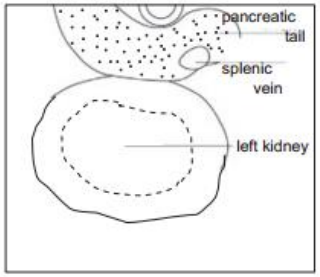
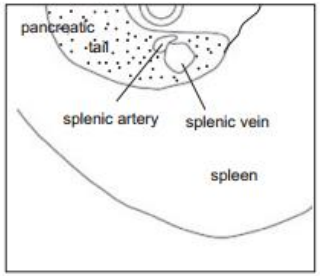
Through Stomach Step4: Torque right & find "seagull"

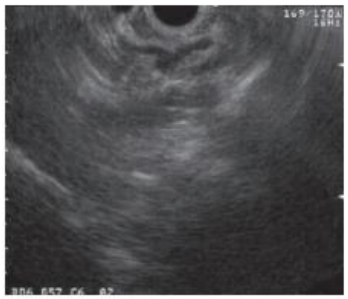
■Step 4

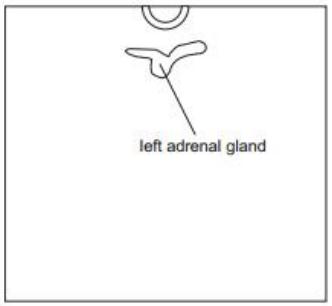






While imaging the spleen by using the splenic vein as the landmark, rotate the scope to visualize the pancreatic tail and left kidney. Rotate the scope further to observe the pancreas until the splenic hilum.





From the above position, advance the scope to observe the left adrenal gland, which is located between the abdominal aorta and upper pole of the left kidney.

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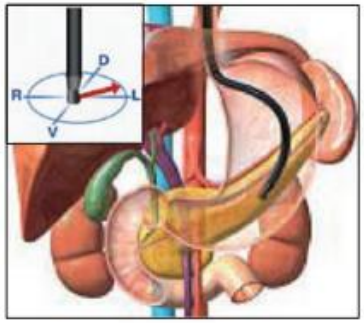
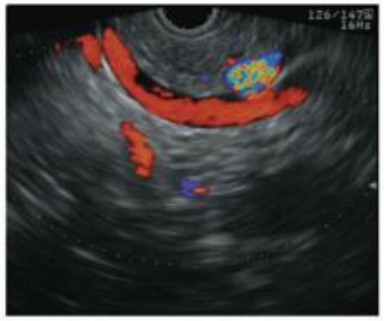
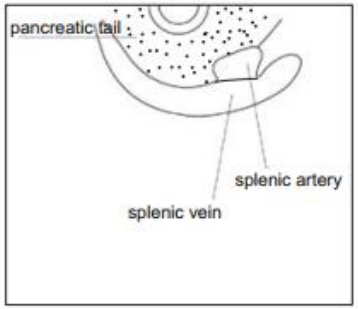
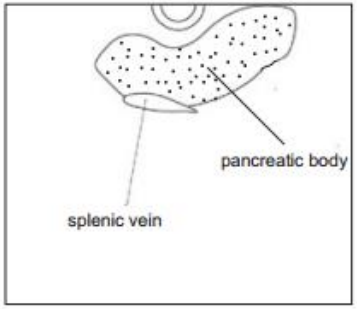
Through Stomach Step5: Torque left & find MPD

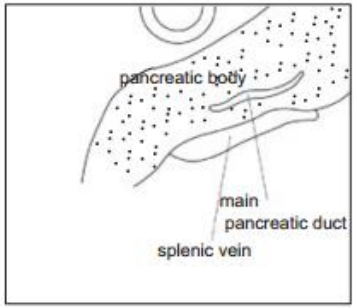
■Step 5











After identifying the splenic hilum, advance the scope while rotating it counterclockwise little by little to observe the pancreas from the tail toward the body. If distinguishing between the splenic artery and splenic vein is difficult, the Doppler mode should be used. Observe the pancreas continuously from the tail to the body.

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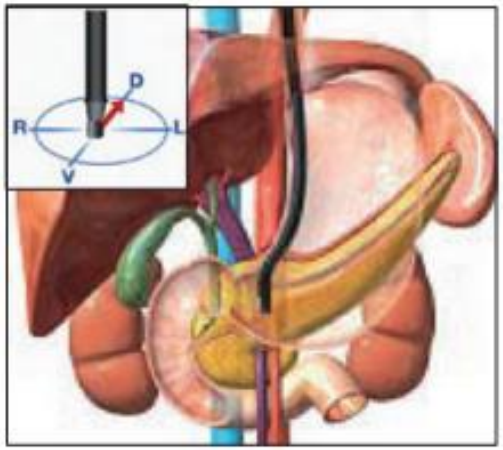
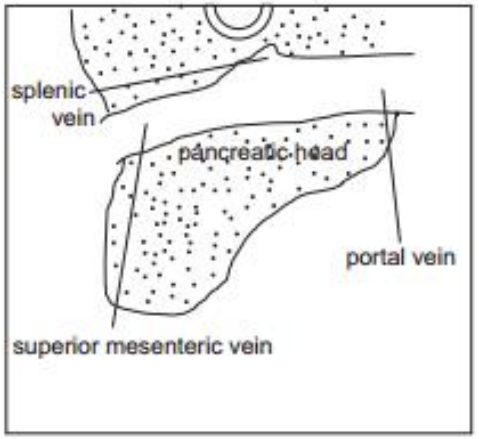
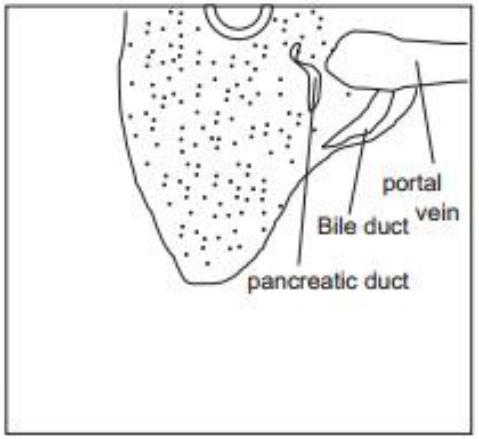
Through Stomach Step6: Torque left & find PV

■Step 6



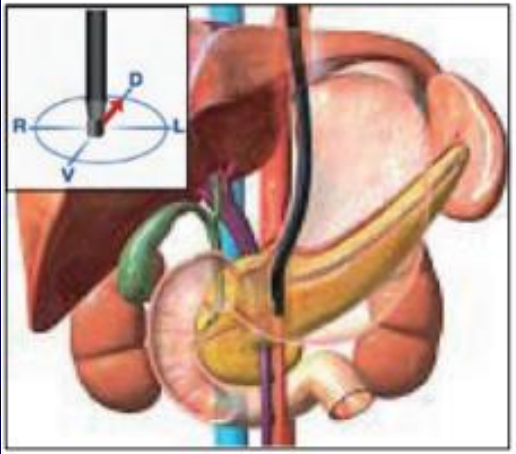


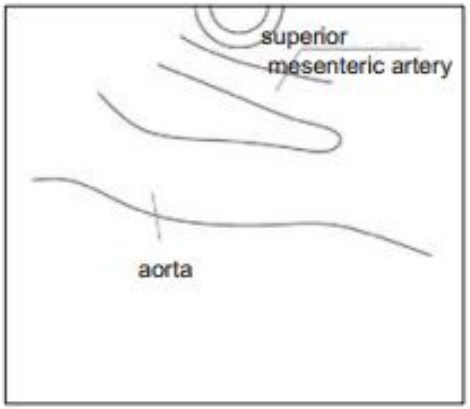


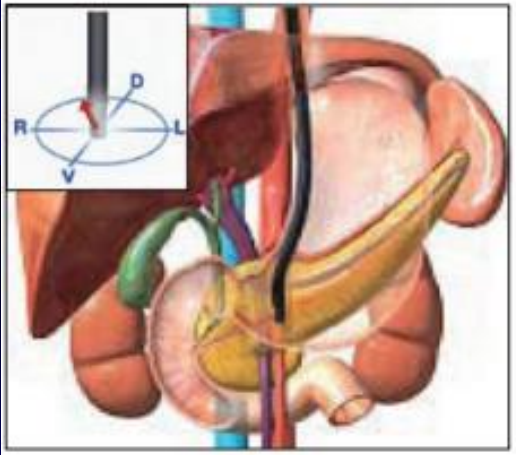
When the splenic vein is traced, the confluence between the superior mesenteric vein and portal vein can be observed. In this position, part of the pancreatic head is also imaged. When the scope is rotated counterclockwise at the portal confluence, the junction between the pancreatic head and body, the main pancreatic duct, and the bile duct can also be observed.

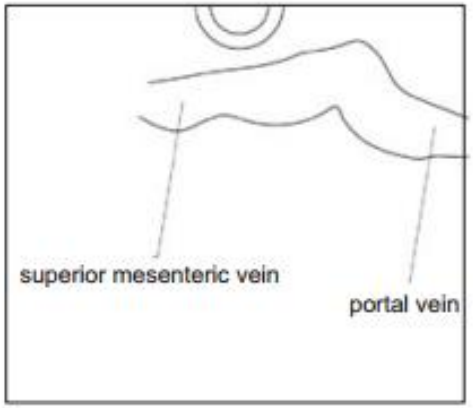
Another way to find PV

* In case of difficulty in tracing the splenic vein to the portal vein confluence









After imaging the superior mesenteric artery from the gastric body, rotate the scope counterclockwise to visualize the superior mesenteric vein that is running parallel to the superior mesenteric artery. Manipulate the scope to visualize the superior mesenteric vein in the longitudinal direction, and then withdraw the scope gradually to observe its junction with the main trunk of the portal vein.

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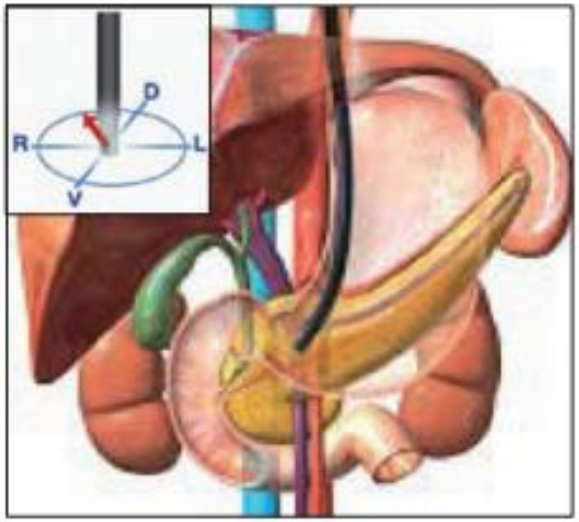
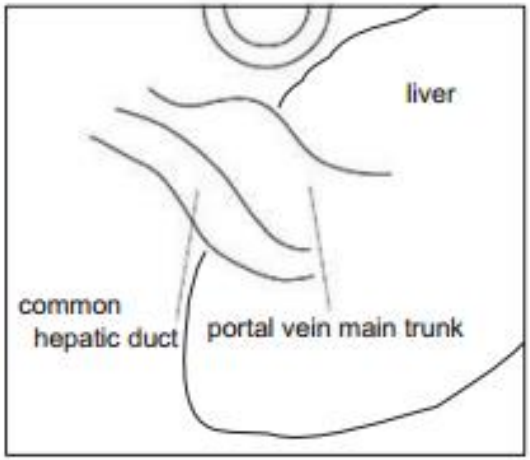
Through Stomach Step7: Pull back & find CBD

■Step 7





After imaging the main trunk of the portal vein, withdraw the scope to trace the portal vein toward the liver. This makes it possible to observe the hilum of the liver.

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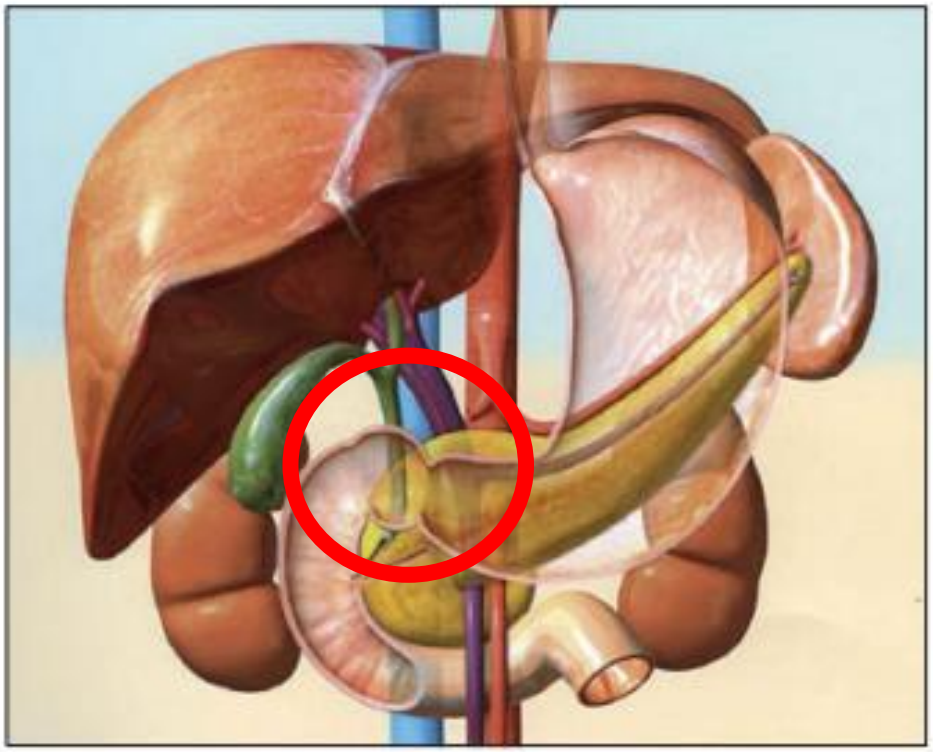
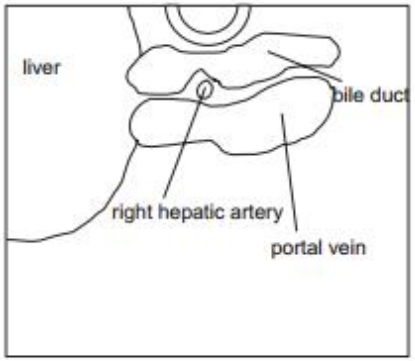
Scanning Position	Landmarks	Tips
Duodenal bulb	Portal vein Superior mesenteric artery/vein Splenic vein IVC Abdominal aorta Gallbladder Bile duct Pancreatic head Pancreatic body	Insert the scope as far as the duodenal bulb and observe using the push technique.



Through the duodenal bulb: Find CBD and PV

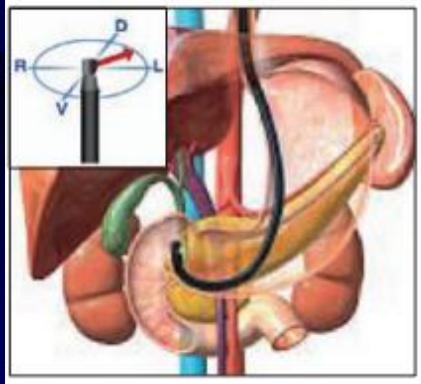
Transducer is looking up at the head!

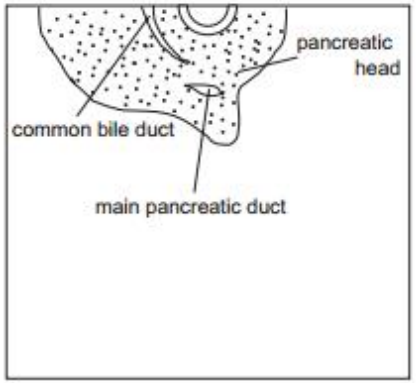
3. Procedure - Scanning from the duodenal bulb -



Advance the scope slightly from this position and rotate it counterclockwise to visualize the portal vein, bile duct and right hepatic artery. At this time, the transducer is directed cranially.

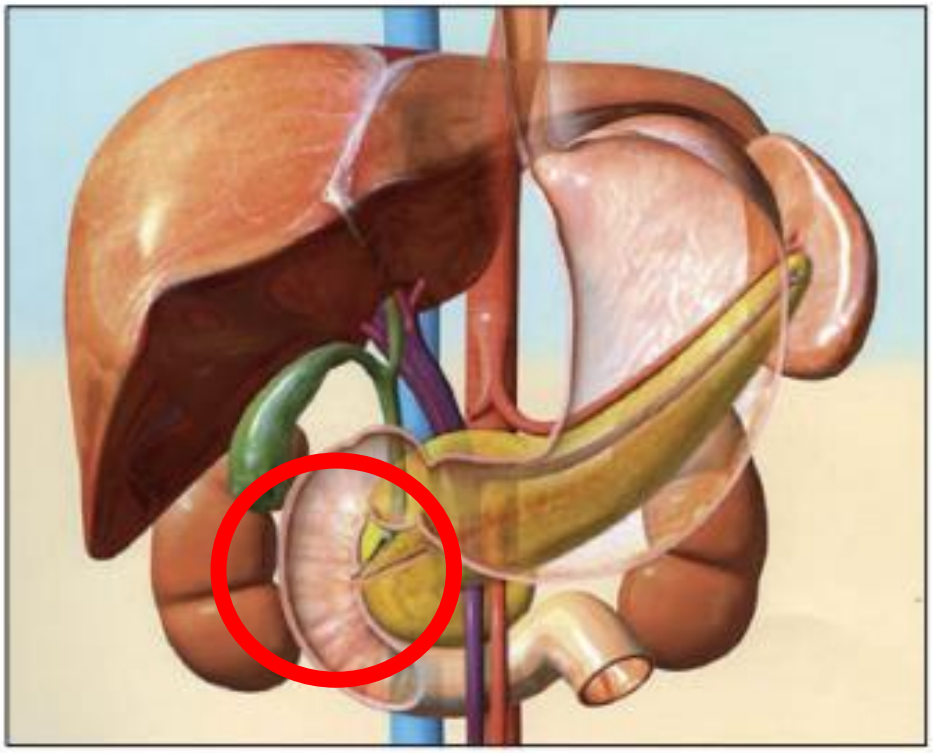
■Step 3





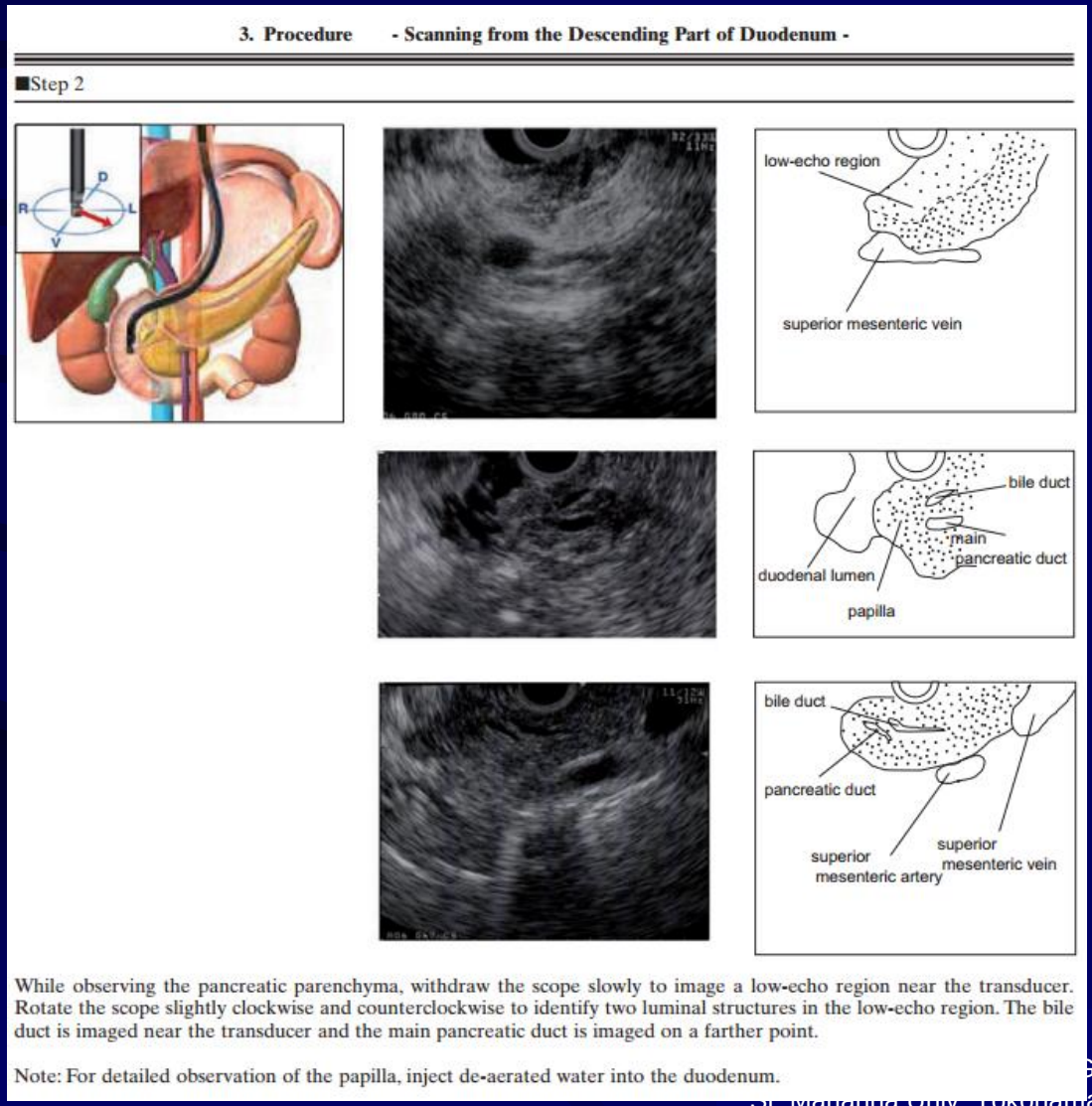
While rotating the scope clockwise, trace the imaged bile duct toward the papilla to visualize the bile duct and main pancreatic duct near the papilla.

Scanning Position	Landmarks	Tips
Descending part of duodenum	Abdominal aorta IVC Superior mesenteric artery/vein Pancreatic head Papilla of Vater Bile duct Right kidney	Straighten the scope in the same way as ERCP (pull technique), and then observe while withdrawing from the distal to proximal duodenum.



Through the descending: Find papilla, CBD and MPD

Transducer is looking down at the foot!



Conclusion

- Be careful for the direction of the transducer!
- If you lose, try to find the landmark!
- Slow movement makes faster acquisition of scope manipulation!

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