

Ultrasound examination of the normal pancreas

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Abstract

The pancreas is a challenge for the beginner in ultrasonography, but patience, perseverance and experience will lead to a complete and correct evaluation of the organ in almost all cases.

A correct examination of the pancreas requires the patient's fasting 7 to 8 hours before the examination. Transverse and longitudinal upper epigastric sections are used to visualize the pancreas, as well as oblique intercostal and subcostal sections (especially for the head and tail). The best ultrasound windows are obtained by using high epigastric sections (that avoid the colon), also by using transgastric sections and sections that use the left liver lobe as an acoustic window. In order to better visualize the pancreas, it is useful to invite the patient to drink 500-700 ml of still water 10-15 minutes before the examination.

To highlight the pancreas, we will start by viewing the landmarks: posterior – the porto-splenic axis and anterior – the gastric antrum and/or the left liver lobe. The echogeneity of the normal pancreas can vary, from hypoechoic to hyperechoic, all normal, provided that the pancreatic parenchyma structure is fine and homogeneous. The Wirsung duct can be visualized in some of the cases, especially in thin patients, its normal maximum diameter should be < 2mm.

For a correct evaluation of the pancreas all its segments must be visualized: head, uncinate process, body, and tail - the latter being the most difficult to visualize.

Key words: pancreas, correct examination, ultrasonography

Rezumat

Evaluarea pancreasului este o piatră de încercare pentru ecografistul începător, dar răbdarea, perseverența și experiența vor duce la vizualizarea corectă a acestuia în marea majoritate a cazurilor.

O examinare în condiții optime se face la pacient a jeun de 7-8 ore. Se folosesc secțiuni transversale și longitudinale prin epigastrul superior, precum și secțiuni oblice intercostale și subcostale (mai ales pentru evaluarea capului și cozii pancreatice). Cele mai bune ferestre ecografice se obțin prin secțiuni epigastrice înalte (evită colonul), prin secțiuni transgastrice și prin incidente ce folosesc ca fereastră acustică lobul hepatic stâng. Vizualizarea pancreasului poate fi îmbunătățită prin administrarea a 500-700 ml apă plată cu 10-15 minute înainte de examinare.

Pentru a evidenția pancreasul se va începe prin vizualizarea reperelor vasculare: axul spleno-portal - situat posterior; precum și a antrului gastric și/sau lobului hepatic stâng – situate anterior. Pancreasul poate fi normo-, hiper- sau ușor hipoeogen în comparație cu ficatul, toate aspecte normale, cu condiția ca ecostructura să fie fin omogenă. Ductul Wirsung poate fi vizualizat, mai ales la indivizii slabi, diametrul său maxim normal fiind mai mic de 2 mm.

Pentru o corectă evaluare a pancreasului toate segmentele sale trebuie vizualizate: cap, proces uncinat, corp și coadă, aceasta din urmă fiind cel mai greu de evidențiat.

Cuvinte cheie: pancreas, examinare corectă, ecografie

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Pancreatic ultrasound is the „touchstone” of the ultrasound examination. Therefore, its examination is a permanent „stress” for every beginner in ultrasonography. Over time, following numerous examinations, performed with patience and perseverance, the ultrasound evaluation of the pancreas becomes a moment of satisfaction, by viewing difficult lesions. But it takes hundreds of ex-

plorations to be able to say that the examination of the normal or pathological pancreas is no longer a difficult stage of ultrasonic examination.

It is imperative that the examination of the pancreas is made on a patient fasting for at least 7-8 hours. The presence of food in the stomach may prevent a thorough and complete examination of the organ, or it can create false images of pancreatic tumors. Liquid ingestion is permitted, but not of carbonated fluids (the air in the stomach will make the examination of the pancreas more difficult).

The examination methods recommended for the pancreas are: grayscale examination, harmonic imaging, as well as Color Doppler, Power or Spectral Doppler. A 3.5 MHz convex transducer (or a multifrequency transducer) for abdomen examination is preferred. In very thin patients, a 5 MHz linear transducer may be needed.

Transverse and longitudinal upper epigastric sections are used to visualize the pancreas, as well as oblique intercostal and subcostal sections (especially for the head and tail). The pancreas can be examined through sections passing above the stomach antrum (if the transducer is placed high in the epigastrium), through transgastric or subgastric sections (the transducer placed approximately halfway between the umbilicus and xiphoid appendix). The best ultrasound windows are obtained by using high epigastric sections (that avoid the colon), also by using transgastric sections and sections that use the left liver lobe as an acoustic window.

In order to be able to see the pancreas through transgastric sections, the antrum (stomach) should not contain air or it should be filled with fluid, this operating as an „acoustic ultrasound window” for the pancreas. Hence, the practical approach, when the pancreas is difficult to visualize: the patient is invited to drink 500-700 ml of still water and examined 10 -15 minutes after. If the examination is performed immediately after water ingestion, the stomach will be filled by a hypoechoic and not transonic fluid, due to the small air bubbles, that form during swallowing. So, after 10-15 minutes, the air bubbles will disappear and the stomach will be filled with transonic liquid, a perfect „acoustic window” for the pancreas. Sometimes we might not find water into the stomach, most often if the examination is made in dorsal decubitus. Then we will invite the patient to sit, so that the water will gather into the antrum, which is the ideal anterior landmark of the pancreas. By positioning the patient in right lateral decubitus, the water will fill the second part of the duodenum, thus better delineating the head of the pancreas.

To highlight the pancreas, we will start by viewing the landmarks: posterior – the porto-splenic axis and

anterior – the gastric antrum and/or the left liver lobe (fig1). Between these elements is found a parenchymal structure: the pancreas. The splenic vein forms the dorsal border of the pancreas, from the splenic hilum to its confluence with the superior mesenteric vein, at the neck of the pancreas. At this point, the head and uncinate process of the pancreas actually wrap around the venous confluence which forms the portal vein, and pancreatic tissue is seen both anterior and posterior to the vein (fig 2). The superior mesenteric vessels are considered the markers of division between the head and body of the pancreas. The head of the pancreas is „cuddled” in the second part of



Fig 1. Normal aspect of the pancreas: PV – portal vein; SV – splenic vein; AO – Aorta; IVC – inferior vena cava; H – head of the pancreas; B – body of the pancreas; T – tail of the pancreas; UP – uncinate process; CV – vertebra.

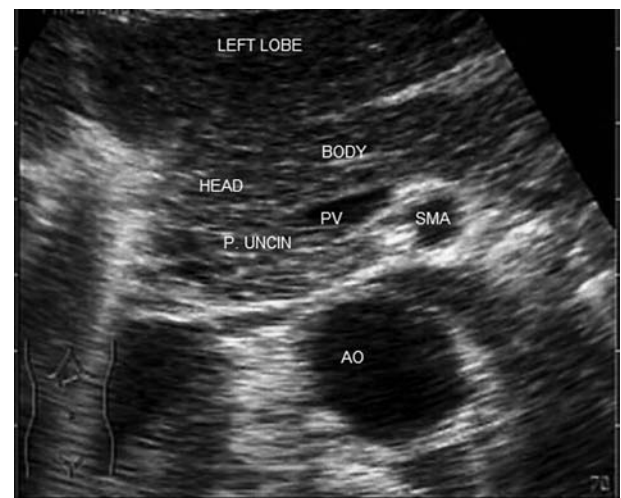


Fig 2. Normal pancreas with the uncinate process: PV – portal vein; SMA – superior mesenteric artery; LEFT LOBE – left liver lobe; HEAD – head of the pancreas; BODY – body of the pancreas; P.UNCIN – uncinate process of the pancreas.

the duodenum and the tail may reach the splenic hilum. Another important landmark is the celiac trunk, which generally takes off the aorta at the superior border of the gland. So, when we find the celiac trunk we angulate the transducer, slightly downward, in order to see the pancreas (fig 3).

The normal pancreatic parenchyma echogeneity is similar to that of the liver (sometimes slightly hypoechoic). In obese or elderly patients, the pancreas can be hyperechoic due to fat load or fibrosis, respectively. So the echogeneity of the normal pancreas can vary, from hypoechoic to hyperechoic (fig 4). All these aspects are normal, provided that the pancreatic parenchyma structure is fine and homogeneous.

The Wirsung duct can be viewed, particularly in young individuals; its diameter should not be larger than 2 mm. Usually only a part of the Wirsung duct is visualized, only rarely throughout its whole length (fig 5).

The pancreas examination in transverse section will highlight much of the pancreas, but almost never the entire pancreas will be seen in the same section. This is because the pancreas has a slightly upward trajectory. In general, we will examine various parts of the pancreas, one by one. The use of transverse sections allows better examination of the pancreatic body and tail. Sagittal sections are preferred for the examination of the pancreatic head. For the pancreatic tail (especially in cases of a „bulbous” one), subcostal recurrent left oblique sections are used. A special attention must be paid to the evaluation of the pancreatic tail that sometimes can be very long. It must be visualized in its entirety so that distal pancreatic tail tumors are not „missed”.

Regarding the normal size of different pancreas segments, opinions vary. We do not consider them very important, because there is great individual variability. The easiest to measure is the body of pancreas, in a transverse section, the normal antero-posterior diameter of the pancreatic body being 15-20 mm. The normal antero-posterior diameter of the pancreatic head is 19-25 mm, and of the tail is generally up to 20-25 mm, but relatively common, the pancreatic tail may have a „bulbous” appearance, that may have greater dimensions. We consider all these pancreatic dimensions purely orientative and with relative value, because on the ultrasound examination of the pancreas the essential element are the structural changes.

The evaluation of the pancreatic head is finished with the evaluation of the main biliary duct (MBD). Right oblique sections are used to see the MBD in the hepatic hilum, but also to see the intrapancreatic choledocus. Sometimes, for a better visualization, the patient should lie in left lateral decubitus (fig 6).

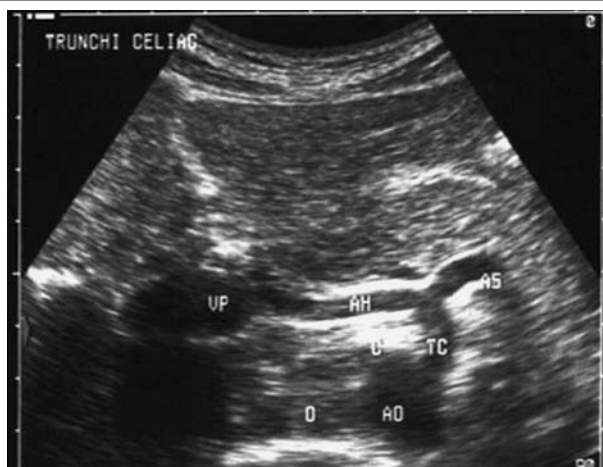


Fig 3. The celiac trunk: VP – portal vein; AH – hepatic artery; AS – splenic artery; TC – celiac trunk; AO – aorta.

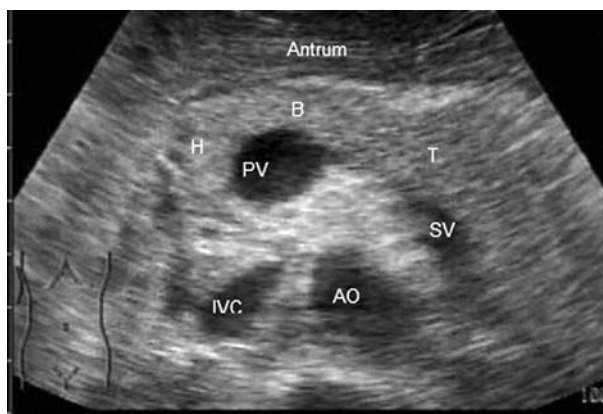


Fig 4. Normal aspect of the pancreas (hyperechoic in an elderly patient): PV – portal vein; SV – splenic vein; AO – Aorta; IVC – inferior vena cava; Antrum – gastric antrum; H – head of the pancreas; B – body of the pancreas; T – tail of the pancreas.

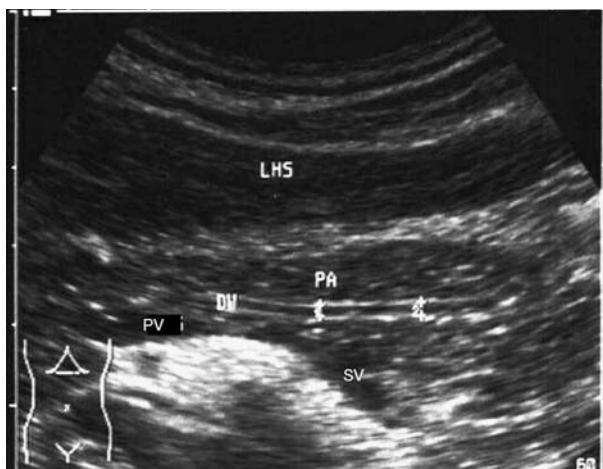


Fig 5. Normal pancreas with visible Wirsung duct. PV – portal vein; SV – splenic vein; LHS – left liver lobe; PA – pancreas; DW – Wirsung duct.

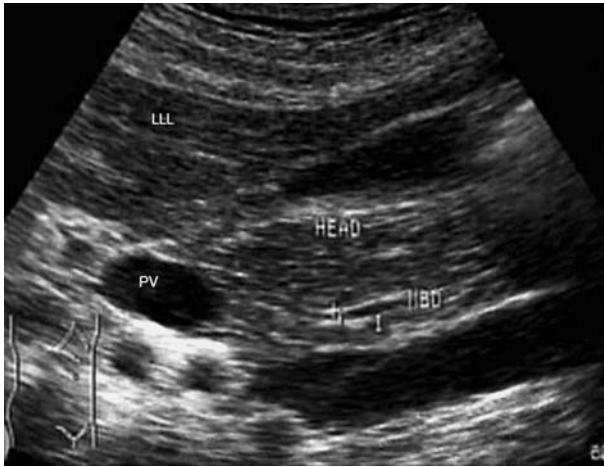


Fig 6. Normal pancreas with visible intrapancreatic main biliary duct. MBD – main biliary duct; LLL – left liver lobe; PV – portal vein; HEAD – pancreatic head.

So, even if the examination of the pancreas is a challenge for the beginner, careful and perseverant examination will allow pancreas evaluation in almost all cases. A correct evaluation of the pancreas must visualize all its segments and assess the ecogeneity and echostructure of the entire organ.

Selective references

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