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Ultrasound examination of the normal gastrointestinal tract

Ioan Sporea, Alina Popescu

Department of Gastroenterology and Hepatology, University of Medicine and Pharmacy Timişoara

Abstract

The sonographic evaluation of the gastrointestinal tract regards experienced sonographers who are able to identify all abdominal and parenchymal structures. Transabdominal ultrasonography allows the evaluation of the entire digestive tract, starting with the oesophagus (especially the oesogastric junction), followed by the examination of the stomach, duodenum and small bowel, and ending with the appendix and colon. In order to be able to find pathological aspects, we should be familiar with the normal ultrasound aspect of different parts of the gastrointestinal tract. By becoming more experienced in abdominal ultrasonography, the visualization of the gastrointestinal tract will become easier.

Keywords: gastrointestinal tract, ultrasonography, normal aspect

Rezumat

Evaluarea ecografică a tubului digestiv se adresează ecografiştilor cu experienţă, care pot recunoaşte structurile abdominale. Ecografia transabdominală poate evalua întregul tract digestiv, pornind de la esofag (în special joncţiunea esogastrică), continuând cu stomacul, duodenul, intestinul subţire, şi terminând cu apendicele şi colonul. Pentru a putea diagnostica aspectele patologice trebuie în primul rând să fim familiarizaţi cu aspectul ecografic al tubului digestiv normal. Odată cu experienţa, examinarea tubului digestiv va deveni tot mai facilă.

Cuvinte cheie: tubul digestiv, ecografia, aspect normal

The sonographic evaluation of the gastrointestinal tract is addressed to experienced sonographers who are able to recognize all abdominal and parenchymal structures. Several technique changes (such as progressive compression of an air-containing organ, water administration in order to improve stomach visualization, or hydrosonography of the colon), the use of 3.5 MHz convex and 5-7.5-10 MHz linear probes, and the use of Power Doppler may help to better visualize the digestive structures.

Transabdominal ultrasonography allows the evaluation of the entire digestive tract, starting with the oesophagus (especially the oesogastric junction), followed by the examination of the stomach, duodenum and small bowel, and ending with the appendix and colon.

The sonographic aspect of the GI tract is represented by 5 layers [1,2]. These layers are visualized with 5 or 7 MHz transducers only if the digestive walls are normal. The 5 layers from interior to exterior are located as follows:

- a hyperechoic inner layer – commonly this represents the border between the digestive fluid and the mucosa.
- a hypoechoic layer – commonly thin, represents the mucosa, lamina propria, lamina muscularis.
- a hyperechoic layer – the submucosa.
- a hypoechoic layer – the muscular layer; its thickness depends upon the segment of the digestive tract.
- an outer hyperechoic layer – the serous layer, the border to the peridigestive fat.

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Address for correspondence: Ioan Sporea
Address: 13 Snagov Str.
300482 Timişoara, Romania
Tel: 0256309455, Fax: 0256488003
Email: isporea@umft.ro

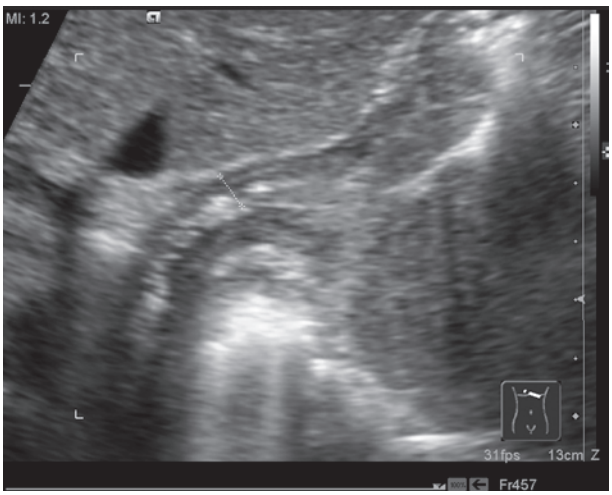


Fig 1. Normal ultrasound aspect of the oesogastric junction, behind the left liver lobe.

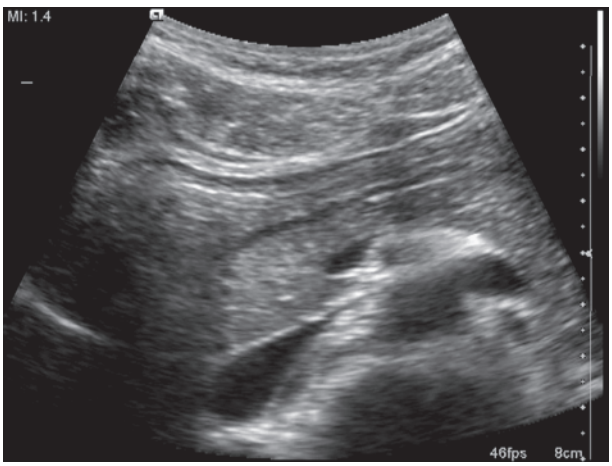


Fig 2. Normal gastric antrum anterior to the pancreatic body

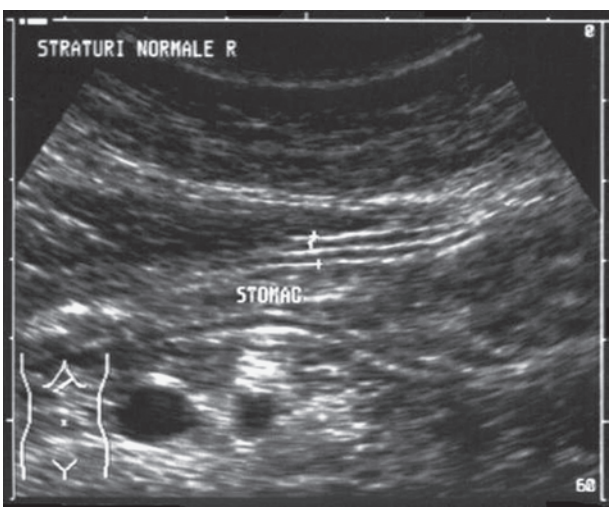


Fig 3. Normal stomach with the normal layers visible

The oesophagus

Because the oesophagus is situated mostly in the thorax, only its distal portion and the oesogastric junction can be visualized by ultrasound. This is easier when there is a large left liver lobe. We use high epigastric sections, where the oesophagus may be seen in front of the aorta and posterior to the left liver lobe (fig 1). We can distinguish the last thoracic portion, as it passes through the diaphragm, the abdominal oesophagus and the oesogastric junction continued by the fornix, with the typical appearance of digestive structures.

Giving the patient water to drink while he is sitting, we can notice by ultrasound the water passing through the distal oesophagus.

We can also visualize the superior oesophagus through the acoustic window of the thyroid lobe.

The stomach

Usually, the stomach may be partially visualized by transabdominal ultrasonography under normal circumstances. The gastric antrum is a reference point that we find posterior to the left liver lobe and anterior to the pancreatic body (we use the antrum to delimit anteriorly the pancreas in a transverse epigastric section) (fig 2). In a fasting patient, in a transverse section, the antrum appears like a glove finger, its walls are hypoechoic and the content is inhomogeneous (air-liquid). In a midsagittal epigastric section, the antrum has a ”target” appearance. The gastric body is usually more difficult to visualize by ultrasound without a previous preparation (fig 3).

In order to obtain a good sonographic visualization of the stomach, we can use plain water (without gas), 500-800 ml. This will allow the filling of a virtual cavity, which will become easier to explore by ultrasound. But we recommend performing the sonographic exploration of the stomach approximately 10-15 minutes after water ingestion, thus allowing the air bubbles to get out of the liquid (fig 4).

The examination of the stomach is usually done with a convex or linear 3.5 MHz transducer, but the study of the gastric wall can be better performed with a 5 MHz probe (less often with 7.5 MHz). The gastric fundus is visualized internal to the spleen and anterior to the left kidney. The gastric body and antrum appear posterior and inferior to the left liver lobe, anterior to the pancreas.

The gastric wall thickness normally ranges between 4 and 6 mm, with the typical sandwich appearance, specific for the digestive tube walls. It can be better measured at the site of the antrum (especially the anterior wall).

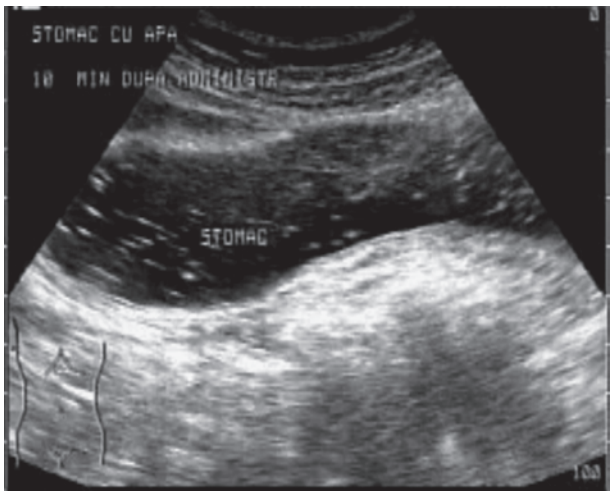


Fig 4. Normal ultrasound aspect of the stomach after plain water ingestion.

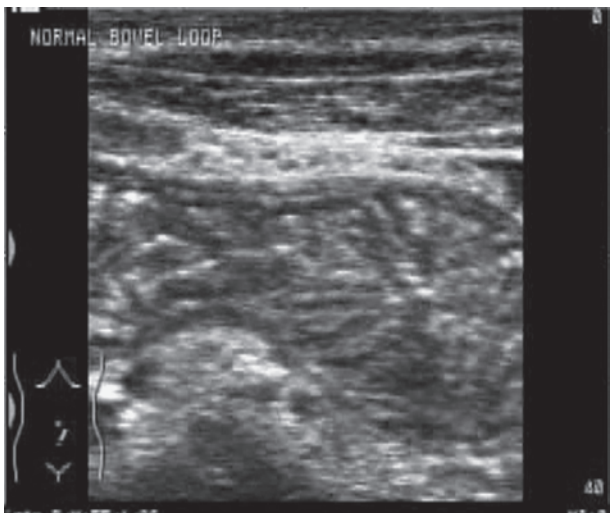


Fig 5. Normal ultrasound aspect of a small bowel loop.

The doudenum

Normally, the duodenum is hardly accessible for ultrasonographic morphological description. It is easier to examine the duodenum after administering water (when the water passes the pylorus) or under obstructive conditions. The first portion of the duodenum continues the gastric antrum, and is situated in front of and higher than the pancreas head and medial to the gallbladder. Most frequently it can be seen next to the gallbladder, and by its air content can be mistaken for a gallbladder stone. The second and third portions of the duodenum (D II and D III) surround the head of the pancreas on its right and inferior sides.

The small bowel

The intestinal loops are easily visualized when ascites is present. They are difficult to examine ultrasonographically with a 3.5 MHz transducer and, therefore, a 5-7 MHz probe is commonly used.

The normal transverse diameter of the intestine should be less than 3 cm and, by exerting pressure with the probe, the peristaltic movements can be noticed (the lack of deformation suggests tumoral or inflammatory infiltration) (fig 5). The normal thickness of the intestinal wall is 3-4 mm [3, 4].

The terminal ileum is an area of interest for a gastroenterologist who performs ultrasonography. We begin the examination by using a 3.5 MHz transducer and then continue with 5-7.5 MHz transducers. The examination of the terminal ileum requires a low transverse section, to allow the scanning of the region situated between the urinary bladder and the caecum (the projection area of the terminal ileum). The normal thickness of the intestinal wall is 2-3mm. Under normal circumstances the walls are thin, peristaltic movements are present and the stratified layers of the walls are evident.

The appendix

The ultrasonographically normal appendix has an external diameter of less than 6 mm and walls with a thickness of up to 2 mm [5]. The examination is performed by transverse scanning in the right lateral abdominal region and thereafter continued with the identification of the right colon and the caecum (organs that contain air, which renders them hyperechoic). We descend with the transducer trying to identify the appendix, usually at the bottom of the caecum, which is easier to visualize under pathological circumstances.

We should be acquainted first with the normal US aspect of the appendix and later with the pathological aspects. It is considered that a normal appendix can be seen in 30-80% of the US examinations, whereas a pathological one may be detected more often by an experienced sonographer.

The colon

Transabdominal US of the colon is more difficult to perform under normal anatomical conditions. From the ultrasound point of view, the digestive structures are better visualized at the level of the descendent or the transverse colon. In a sagittal section, the descendent colon appears as a tube containing air (fig 6, fig 7), which in transverse section has a 'bull's eye' appearance, with thin

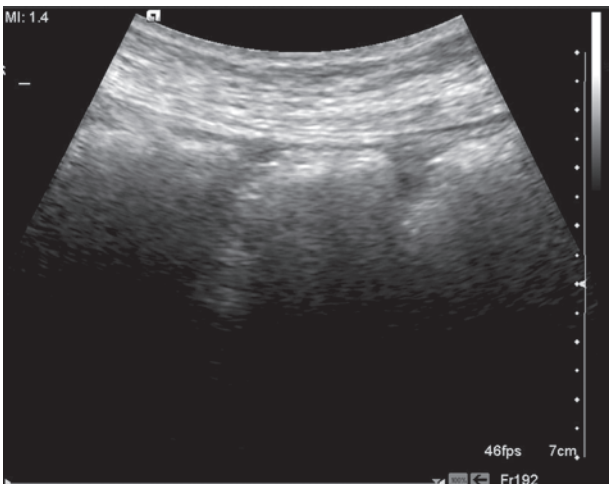


Fig 6. Normal ultrasound aspect of the colon with the a convex probe.

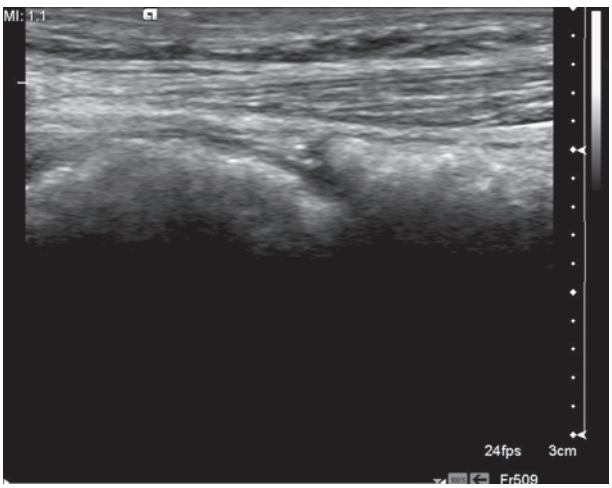


Fig 7. Normal ultrasound aspect of the colon with the a linear probe.

walls of 2-3 mm. The colon can be studied at the same time with the practical use of colonic hydrosonography. An adequate preparation (cleaning) of the colon is compulsory and should be performed in a similar manner to that for colonoscopy or barium enema. Intrarectally are introduced 1500 ml of water, which allows for the visualization of the entire colon as an ultrasonic structure. In order to improve the examination, spasmolytic drugs (scobutil i.v.) may be administered before the examination. By using colonic hydrosonography, the colonic walls and the 5 layers of the colon may be visualized by means of high frequency transducers [6,7]. Furthermore, this method allows for the examination of the colonic haustra, colonic motility, parietal thickness, and potentially protrusive tumours.

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