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US evaluation of patients affected by IBD: How to do it, methods and findings

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ABSTRACT

Intestinal US has to be performed very accurately, to obtain an exploration of both small bowel and cholical loops that will be the most complete that is possible; so, this technique requires adequately trained operators. Convex and linear probes with frequency between 3.5 and 7.5 MHz are used: the first ones for the panoramic evaluation and to study the middle-distal sigma and rectum; the second ones to perform a detailed examination of the bowel wall. US allows to evaluate not only the thickness and structure of the bowel wall, but also the content and peristalsis of the loops, their compressibility and movability, the perivisceral spaces and the abdominal organs. In Crohn's disease, US, completed everytime by the color–power-Doppler, shows wall thickening until 20 mm and above, with multi-stratified structure that could be regular, or more and more altered until the hypoechogenic view; the bowel vascularisation could be absent or less or more increased, due to the stadium of the disease itself.

Furthermore, US allows to demonstrate the presence of stenosis and various other complications (abscesses inside or outside the walls, fistulas, involvement of other organs, free fluid collections); the use of II generation US contrast media could afford information about the activity of the disease.

US has a very important role in the follow-up of patients with diagnosis of Crohn's disease, to monitor the response to the medical therapy and to discover complications; US must be performed as first in subjects with abdominal pain and diarrhea, to select the ones that need more invasive examinations.

1. Introduction

For many years, US was considered unsuitable for the study of the bowel as the gaseous content of the loops leads to a dispersion of the ultrasound beam.

At the present time US has a definite part to play in diagnostic procedures regarding a number of diseases, particularly IBD, and is used to integrate both traditional and endoscopic radiological investigations. In clinical practice US is now generally the first instrumental investigation to be carried out in subjects with problems related to the gastro-intestinal tract and helps in the selection of patients that have to undergo more complex instrumental procedures.

US moreover provides information that is difficult to obtain with other imaging techniques as it is the only one that makes it possible to study the following in real time:

- morphological aspects of the full thickness of the bowel wall;
- functional characteristics;
- perivisceral spaces;
- abdominal parenchymatous organs.

2. Technique

Intestinal US is carried out by the transabdominal route using convex and linear probes with frequency between 3.5 and 7.5 MHz.

The 3.5 MHz probes provide a panoramic view of great utility in obese patients and for the evaluation of the sigma-rectum through the vescical window; 7.5 MHz probes are indispensable for detailed examination of the bowel wall and its vascularisation.

In actual fact the two types of probes are used in alternation in the course of the investigation owing to the need to pass from a panoramic evaluation of the perivisceral spaces and abdominal organs to a detailed examination of the bowel wall [1].

For the study of the ano-rectal region an endoluminal approach is necessary with linear or rotary probes of frequency between 7.5 and 12 MHz or, alternatively, the trans-perineal approach with convex and/or linear probes of frequency between 3.5 and 7.5 MHz.

Except some particular cases, US of the intestinal tract does not require any specific preparation other than the repletion, albeit moderate, of the bladder for the evaluation of the mid-distal sigmoid colon and of the rectum.

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In the 90s the hydrocholonsonography (HCUS) was proposed for the study of colonic walls [2]; the technique is done after water enema (from 1000 to 3000 ml) and administration of antispasmodic. HCUS never entered clinical practice, because of contrasting results.

At the end of the 90s the use of an oral contrast medium (polyethilenglycole) was proposed in the study of small bowel, to dilate the lumen of the bowel, increasing the visibility of the wall structure [3]; this technique (SICUS) needs long time for its execution and it could be useful only in cases of doubtful interpretation of conventional US or in training of non-expert operators.

3. Sonographic imaging of the intestine

US of the colon and bowel loops is characterised by poor anatomic reference points for the identification of the evaluated segment of intestine.

Generally, the examination starts at the level of the left iliac fossa where the sigmoid colon is always identifiable below the abdominal wall, and proceeds along the colon in a retrograde direction as far as the caecum. The colon stands out from the loops of the small intestine for the presence of circumferential muscular sheathes that give a characteristic wavy appearance (Fig. 1) to the gaseous content which therefore does not represent an impediment to the examination but rather an element that is useful for identifying the intestinal segment.

The loops of the small intestine can be fully identified and explored; in general a topographic criterion is used for distinguishing the jejunum from the ileum.

3.1. Morphological and functional aspects

US allows us to evacuate the thickness and echostructure of the bowel wall.

The ultrasonographic image of the normal bowel wall consists of five layers of different echogenicity (Fig. 2):

(1) hyperechogenic layer—it corresponds to the mucosa or interface between mucosa and intestinal content;
(2) hypoechogenic layer—it corresponds to the muscularis mucosae and is thicker than the previous one;
(3) hyperechogenic layer—it is the most echogenic layer and corresponds to the submucosa;
(4) hypoechogenic layer—it corresponds to the tunica muscularis propria;
(5) hyperechogenic layer—it is the most external layer, of variable thickness, and corresponds to the serosa or the interface between serosa and perivisceral tissue.

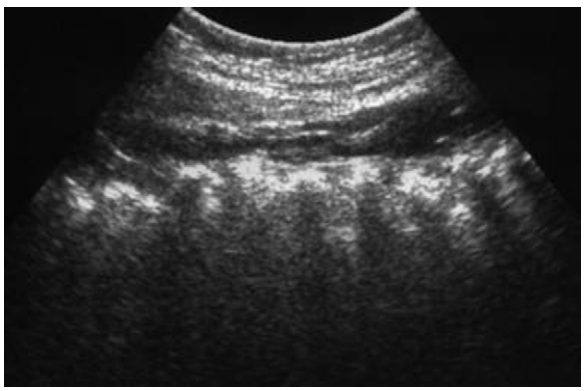

Fig. 1. Usual "wave-like" view of gas inside the bowel lumen.

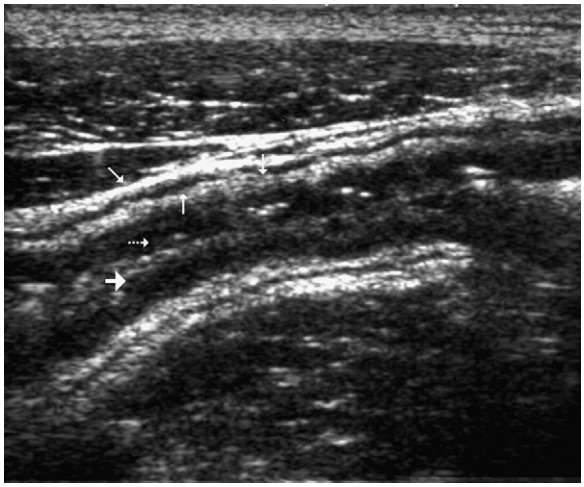

Fig. 2. Small bowel: regular view of the wall and of its stratification; central hyperechogenic: mucosal interface (➔); hypoechogenic: muscularis mucosae (⇢); hyperechogenic: submucosa (↑); hypoechogenic: muscularis propria (↓); hyperechogenic: sierosa (↘).

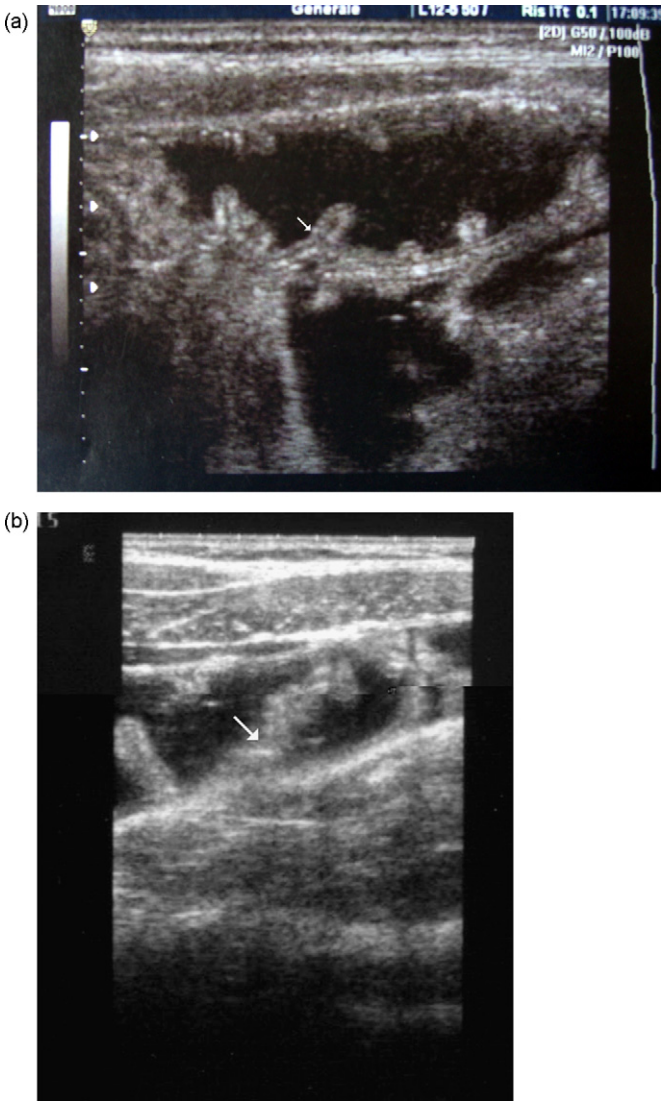

Fig. 3. (a, b) Bowel loop with liquid content and view of connivent valves.