Ultrasonographic aspects in Crohn's disease in pediatric patients

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Learning objectives

Learn the ultrasonographic changes of the bowel wall and of the extradigestive structures in children with Crohn's disease.

Learn the contribution that ultrasound can have in diagnostic and evaluation of abdominal pathology in Crohn's disease in the pediatric age.

Background

Crohn's disease is an idiopathic inflammatory bowel disease with a chronic recurrent evolution. It affects the wall of any segment of the digestive tract, the peritoneal serous membrane, the mesentery or the regional lymph nodes. The onset of the disease is around the age of 20-30 years old (but it can occur at any age) with digestive and extradigestive manifestations.

The abdominal ultrasonography is the best imaging technique indicated in the diagnosis of Crohn's disease in children, because it is not irradiating or invasive, it does not need sedation and in some cases it does not even need the introduction of water in the intestine in order to perform a hydrosonography.

Findings and procedure details

The ultrasonographic normal aspect of the bowel wall consists in 5 layers which are visualized with 5 or 7 MHz transducers.

The 5 layers from exterior to interior are:

- an outer hyperechoic layer - the serous layer, the border to the peridigestive fat
- a hypoechoic layer - the muscular layer with a thickness depending upon the segment of the digestive tract
- a hyperechoic layer - the submucosa
- a hypoechoic layer - the mucosa, commonly thin
- a hyperechoic inner layer - the border between the digestive fluid and the mucosa.
The aspects seen in Crohn's disease through ultrasonography are: alteration of the bowel wall (Fig.3, Fig.4, Fig.5) like loss of the stratification (Fig.7) and ulcerations, changes in the parietal vascularisation (vasa recta) (Fig.6), narrowing of the lumen. There are also peri intestinal manifestations - lymph nodes, fibro-fatty infiltration, diminution/disappearance of the intestinal peristaltic (Fig.7) and complications like stenosis (Fig.8), fistulae (Fig.9, Fig.10), or abscesses (Fig.10, Fig.11). The flow in the mesenteric arteries is higher in children with intestinal bowel disease.

It is important to search for the signs of "activity" of the disease given by mural inflammation (in this case Doppler ultrasound is not enough, MRE or contrast enhanced ultrasonography is needed) in which case drug therapy it is used, whereas in cases with fibrosis surgical treatment is required.

In few cases the ultrasonography is inconclusive or can not be properly conducted and thus other complementary examination needs to be done.

Other imaging techniques that can be used are:

- Magnetic resonance enteroclysis/enterography (MRE) - preferable in children because of the lack of irradiation.

- Computed tomography enteroclysis/enterography are important because of the information they give (localisation, complications), but, due to irradiation and sedation issues, they are usually avoided in children.

- Barium X-ray series (conventional enteroclysis) is mainly not used any more because even though it gives information about the anatomical localisation it does not see the bowel wall and the peri intestinal changes.

- Dynamic Enhanced MRI, MR perfusion - can be used in improving the ability to predict response to therapy.

- Molecular Imaging might improve the initial evaluation of patients with Crohn's disease.

- PET/scintigraphy - detection of active bowel inflammation.

- Advanced Endoscopic Mucosal Imaging permits the detection of subtle mucosal lesions.

- Videcapsule - expensive and mostly unreliable in cases with lumen stenosis.

The differential diagnosis of Crohn's disease is mainly done with the ulcerative colitis (Fig.12), but there are other diseases where the bowel wall is affected and thus a differential diagnosis with Crohn's disease needs to be done like: intestinal tuberculosis, diverticulitis, infectious gastroenteritis/colitis, ischemic colitis,
pseudomembranous colitis, chronic radiation enteritis, irritable bowel syndrome, Behcet's disease, celiac disease, anal fissures, cancers/carcinoid intestinal tumors, lymphoma, endometriosis, giardiasis, amoebiasis, ascariasis (Fig.13) or acute appendicitis.

The main advantages in using ultrasonography in children with Crohn's disease are that it is widely available, not affected by patient motion (truly important in the pediatric age), cheap, repeatable, non-invasive (if colon hydrosonography is not performed) and most of all non irritrating.

Also ultrasonography has an important role not only in depicting the abdominal changes at the onset of the disease but also it holds a great place in following the response to therapy and detecting the recurrence of inflammation after surgical treatment.

Like every other imaging technique, ultrasonography has disadvantages also like that it is operator-dependent (the doctor needs some experience with this type of ultrasonography), it is time-commitment and the rectal and perianal areas are difficult to explore.

**Images for this section:**

![Normal aspect of the bowel wall in the terminal ileum.](image-url)

**Fig. 1:** Normal aspect of the bowel wall in the terminal ileum.
Fig. 2: Normal aspect of the bowel wall of the colon with haustra coli.
Fig. 3: Visualisation of all the bowel wall layers at the level of the ileum with thickened submucosa and lymph node adjacent, in the surrounding fat.
Fig. 4: Submucosal thickening and hypervascularisation at the level of the right colon.
Fig. 5: Hypervascularisation of the submucosa in the right colon.
**Fig. 6:** Vasa recta (dilatation and tortuosity of the small arteries that supply the intestine) - specific in Crohn's disease.
Fig. 7: Loss of normal stratification of the bowel wall, lack of peristalsis, fibro-fatty infiltration and lymph nodes.
Fig. 8: Loss of stratification of the bowel wall; stenosis as complication of the disease.
Fig. 9: Entero-mesenteric fistula at the level of the ileum.
**Fig. 10:** Fistula with abscess formation - complications of Crohn's disease, at the level of the lower right quadrant.
Fig. 11: Ischiorectal abscess seen by ultrasound and confirmed by the MRI.
Fig. 12: Patient with ulcerative colitis (differential diagnosis with Crohn's disease). Loss of haustra coli. Wall thickening with an irregular margin - a non specific finding in an inflammatory bowel disease, aspect probable in favour of small ulcerations.
**Fig. 13:** An image of an *Ascaris lumbricoides*, found in an intestinal lumen. The disease can give the same changes we find in Crohn's disease, therefore, being a diagnosis to be taken under consideration.
Conclusion

Abdominal ultrasonography is the preferred imaging technique in children with Crohn's disease. It can be used in the initial assessment of the disease and in monitoring after surgical treatment or assessment of response to drug therapy.

Not only that the information that it brings are reliable but most important of all - it lacks radiation.

Personal information

References


