CT ENTEROGRAPHY FOR CROHN'S DISEASE

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Abstract
Cross-sectional imaging techniques are currently a mainstay of evaluation of patients with Crohn's disease due to their ability to evaluate the entire bowel and extra-luminal complications including abscess and fistulas. CT enterography is most commonly performed imaging modality, because of the wide accessibility and the lower price. Recently CT enterography has demonstrated very good efficacy both in detection of Crohn's disease as well as in differentiation of active from chronic small intestine changes.
Keywords: Crohn's disease, small intestine, CT enterography

Introduction
Crohn’s disease (CD) is a chronic, relapsing inflammatory bowel disease. It can affect any part of the gastrointestinal tract, most commonly ileum and colon. The CD pathogenesis has not been fully clarified, but currently it is assumed that the disease is a result of inappropriate immune response to intestinal microflora in genetically susceptible individuals. Diagnosis and evaluation of patients suspected to have IBD can be challenging for the gastroenterologist. CD diagnosis is based on clinical and additional tests. Among the additional tests, enterography with CT enterography has shown good results in the evaluation of this disease. One of the main indications for CT enterography (CTE) is the detection and evaluation of Crohn's disease. CTE is a imaging modality that provides detailed images of the small bowel by using a low Hounsfield unit (negative) oral contrast media, intravenous contrast and thin cut, multiplanar CT acquisitions to optimize small bowel imaging.

CT protocol
Patients have to fast at least for 4 h prior to the CTE. Patients can freely drink clear fluids to support of hydration prior to exam. Patients are instructed to drink 1000-1500 ml of negative contrast. Negative CM through the bowel lumen have advantages that outweigh those offered by positive CM for the following reasons: lower costs, low viscosity, faster injections, and better view of enhancement, wall thickening and mesenteric involvement. 500 ml of contrast are given at 45 minutes, at 30 minutes and at 15 minutes before the study. When CT scan starts, 100-150 ml of nonionic IV contrast medium is administered at a rate of 2,5-4 ml/s. The imaging is conducted 40 seconds after the administration of the intravenous contrast medium is started. A multidetector CT scanner must be used with 2-mm slices and 1-mm section thickness, 200 mA and 120 kVp.
Reconstructions must be performed in three planes. Coronal reconstructions are most appropriate (at 3-5 mm intervals). Polyethylene glycol and mannitol are used as negative oral contrast material. When polyethylene glycol is used, 750 ml are administered in 45 minutes (one glass every 10 minutes), and 750 ml are administered in less than 25-30 minutes (one glass every 5 minutes), before the start of examination. When mannitol is used as the negative oral contrast, 1500 ml must be administered in 30 to 40 minutes. Patient compliance is crucial to the success of CTE, and surveillance and stimulation during the drinking phase is recommended. Patients are placed in the prone decubitus position to obtain distension and redistribution of the loops, and an intramuscular injection of N-butyl hyoscine bromide is administered to avoid peristaltic activity in the gastrointestinal tract. Iodinated contrast material is administered intravenously at a rate of 2.5-4 ml/s with an approximate volume of 120 ml (100-150 ml) and two or three contrast-enhanced series are obtained in the arterial phase (at 40 seconds) and one in the portal phase (at 70 seconds after the administration of contrast media). Third series is optional. If there is a non-characterized lesion in the hepatic parenchyma a delayed phase is performed at 3 minutes. If there are pathology associated with the excretory system a delayed phase is performed at 10 minutes. Thus is to avoid unnecessary phases that imply further exposure of patients to radiation. Exact detection of small bowel pathology requires considerate luminal navigation from the gastro-oesophageal junction to the anus. [2,3]

Radiological signs
The main radiological signs of Crohn's disease, its inflammatory activity and its complications include:
- Wall thickening: Thickening of the wall of the small intestine is the most common radiological sign. With adequate distension the normal bowel wall has a thickness of 1-3 mm. A common categorization is 3-5 mm for mild thickening, 5-7 mm for moderate thickening and > 7 mm for marked thickening of the bowel wall. Increased bowel wall thickness is one of the most common signs of inflammatory activity, but not specific only for Crohn's disease.

Figure 1. Wall thickening

-Mucous enhancement: It presents visual comparison between affected and healthy adjacent loops. Abnormal intestinal wall enhancement after venous application of contrast agent is the result of increased angiogenesis and vascular permeability. It is seen both in active disease and fibrosis. Enhancement of the bowel wall can be categorized as homogeneous, mucosal and layered. The latter two enhancement patterns can only be
evaluated when the bowel wall is thickened. A layered pattern is considered to depict more severe disease activity compared to the mucosal pattern, which in turn is more severe than a homogeneous pattern. At the same time different degrees of inflammation and fibrosis can be present and a layered pattern of enhancement has also been associated with fibrosis. [1,6,9]

- "Comb sign": This imaging finding corresponds to the vasa recta dilatation from the inflammatory process. The engorged vessels have a linear appearance, like the teeth of a hair comb. Increased vascularity of the mesentery is seen in active inflammation.

- Skip lesions: Skip lesions and patchy inflammation are classic finding in CD, in contrast to the uninterrupted inflammation, which is seen in ulcerative colitis. Skip lesions refers to the interspersed inflammation "skipping" parts of the bowel, which are left unaffected.

- Increased density of the fat adjacent to the loop. This condition is also called fibrofatty proliferation or fat wrapping, which are different names for hypertrophy of the subserosal fat. It is a common sign in longstanding CD. [4,8]

- Regional lymph node enlargement. It is assumed when lymph nodes measuring ≥ 5 mm along its short axis.

- Stenosis: It represents reduction of the caliber of the loop with upstream dilatation, characterized by the small loop segment having a cross-sectional diameter > 2.5 cm, with or
without narrowing of the distal bowel segment. Stenosis can present as bowel wall thickening combined with lumen narrowing. The presence of a prestenotic dilatation increases the probability of a stenosis. There is usually present an abnormal contrast enhancement of the affected bowel segment. Only severe stenosis is considered as a complication. The latter is determined as a stenosis with prestenotic dilatation.[3]
-Fistula: It is defined as a linear tubular finding, with peripheral contrast enhancement, connecting two anatomical structures, with or without fluid or air content. Due to the complicated structure, the exact path of a fistula can be difficult to establish.

-Infilt rate: It can be seen as creeping fat between bowel loops with substitution of the fat signal density and tethering and kinking of bowel loops. There are often present fistulas and abscesses. There can be also obstruction symptoms due to adhesions, fibrosis or inflammatory narrowing.[6,7]

-Length of small bowel involvement: For the purpose of differential diagnosis, the length of small bowel involvement can be divided into focal (<5 cm), segmental (6–40 cm) and diffuse (>40 cm). In Crohn’s disease focal and segmental small bowel wall thickening are typically found.

CTE is an accurate preoperative diagnostic modality for small-bowel CD. The ability of this imaging technique to detect both luminal and extraluminal pathology is a distinct advantage of CTE compared with small-bowel barium contrast studies.

Conclusions

CT enterography is readily available and easy to perform imaging technique. It makes it possible to determine the stage of progression and extent of inflammatory bowel disease, extraintestinal involvement and potential complications. The method combines accessibility and availability, a short examination time with a single breath hold acquisitions. These advantages make CTE an important tool in the diagnosis and follow-up of patients with Crohn's disease. It should not be forgotten that each method provides different data on CD. Therefore different diagnostic techniques complement each other. Confirmation by different methods increases diagnostic accuracy when findings are not convincing. CTE provides a highly accurate method for diagnosis and assessment of CD. In addition, a single exam can assess extent, severity, and location of disease, associated with extraluminal manifestations and complications.

References


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