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## Original Article

# CT enterography in the evaluation of Crohn's disease



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## ABSTRACT

**Proposition:** Crohn's disease (CD) is a chronic inflammatory process that affects various parts of the gastrointestinal tract, from the mouth to the anus with unknown etiology and variable clinical presentation. CD diagnosis is based on clinical and complementary tests. Among the complementary tests, enterography with CT enterography has shown good results in the evaluation of this disease.

**Methods:** The patients evaluated were submitted to a questionnaire on the clinical manifestations of the disease and an CT enterography was obtained. The studies were reviewed by an experienced radiologist looking for radiological signs of CD.

**Results:** The mean age was 40 years, with a predominance of women. The main clinical manifestations are diarrhea in 24 (70%), hematochezia in 19 (55%), abdominal pain in 29 (85%) and weight loss in 22 (64%) patients. The main findings on CT enterography were an intestinal wall enhancement signal in 23 patients (67%), vascular engorgement (*vasa recta*) in 20 (58%), parenteral fat densification in 14 (41%), intestinal wall thickening in 22 (64%), and lymph node enlargement in 17 (50%) of patients.

**Conclusion:** This study showed that CT enterography presents a good assessment of intestinal involvement by CD.

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## Enterografia por tomografia computadorizada na avaliação da doença de Crohn

## R E S U M O

**Proposição:** A doença de Crohn (DC) é um processo inflamatório crônico que acomete vários locais do trato gastrointestinal, desde a boca até o ânus, tendo etiologia desconhecida e apresentação clínica variável. Seu diagnóstico baseia-se no exame clínico e em testes

### Palavras-chave:

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complementares. Dentre os exames complementares, a Enterografia por Tomografia Computadorizada (Entero-TC) tem mostrado bons resultados na avaliação dessa doença.

**Metodologia:** Os pacientes avaliados foram submetidos a um questionário sobre as manifestações clínicas da doença e realizaram Entero-TC. Esses exames foram analisados por um radiologista experiente, à procura de sinais radiológicos da DC.

**Resultados:** A idade média foi de 40 anos, com predomínio de mulheres. As principais manifestações clínicas foram diarreia em 24 (70%), hematoquezia em 19 (55%), dor abdominal em 29 (85%) e perda de peso em 22 (64%) dos pacientes. Os principais achados na Entero-TC foram o sinal de realce de parede intestinal em 23 pacientes (67%), ingurgitamento vascular (*vasa recta*) em 20 (58%), densificação de gordura perientérica em 14 (41%), espessamento de parede intestinal em 22 (64%) e linfonodomegalia em 17 (50%) dos pacientes avaliados.

**Conclusão:** O presente estudo mostrou que a Entero-TC apresenta boa avaliação do acometimento intestinal pela DC.

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## Introduction

Crohn's disease (CD) is a chronic inflammatory process that affects various parts of the gastrointestinal tract, from the mouth to the anus.<sup>1,2</sup> CD has shown an increase in its prevalence since the second half of the twentieth century and, despite major advances in understanding the basic mechanisms of inflammation and pathogenesis, its cause remains unknown.<sup>1</sup>

With an extremely variable clinical presentation, CD exhibits symptoms and prevalent injuries that differ according to their location, extent, systemic manifestations and potential complications. In general, CD exhibits as early symptoms: abdominal pain, associated with persistent diarrhea, weight loss, mild fever and extra-intestinal manifestations.<sup>2</sup>

The diagnosis of CD is based on the analysis of clinical data, as history and a complete physical and proctologic examination, besides endoscopic, radiological, laboratory and histological tests.<sup>3</sup> Undoubtedly, colonoscopy has proven to be the test of choice for the diagnosis of this disease, since it allows a complete evaluation of the large bowel, ileocecal valve and terminal ileum, areas commonly affected by the disease. However, in its most part, the small intestine cannot be evaluated by this method.

For several years, barium studies were considered as the gold standard in the investigation of diseases of the small intestine, for example, conventional enteroclysis and intestinal transit,<sup>3</sup> with great impact on the diagnosis, evaluation of their anatomical distribution, the presence of complications such as stencils, fistulae, abscesses, and signs of acute exacerbation.<sup>4</sup>

With the development of imaging studies, the enterography, either by computed tomography or magnetic resonance imaging, is replacing the intestinal transit and enteroclysis procedures in the imaging evaluation of the small intestine. The advantage of CT enterography is to allow a visualization of the entire small intestine, without overlapping loops, thus allowing the evaluation of the intestinal wall, detection of extra-luminal pathological conditions, and potential associated changes.

Many of these findings are not seen in traditional endoscopic studies, which favors the progressive replacement of old methods by the enterography as the main method of diagnosis of inflammatory bowel disease (IBD).<sup>5-8</sup>

The early studies with CT enterography showed a high degree of sensitivity, above 85%, for the diagnosis of active CD, when compared with barium enteroclysis. Recent studies have demonstrated a sensitivity rate of up to 100% and specificity of 53.9% for the identification of CD in its active phase.<sup>7</sup> Other papers have shown that CT enterography is equivalent to MR enterography for the assessment of CD activity.

Despite studies showing good results with CT enterography, there are few publications on this subject in Brazil; thus, it is essential to carry out this study in our midst.

## Goal

The aim of this study was to analyze the radiological findings of CT enterography, relating them to the clinical manifestations in patients with CD.

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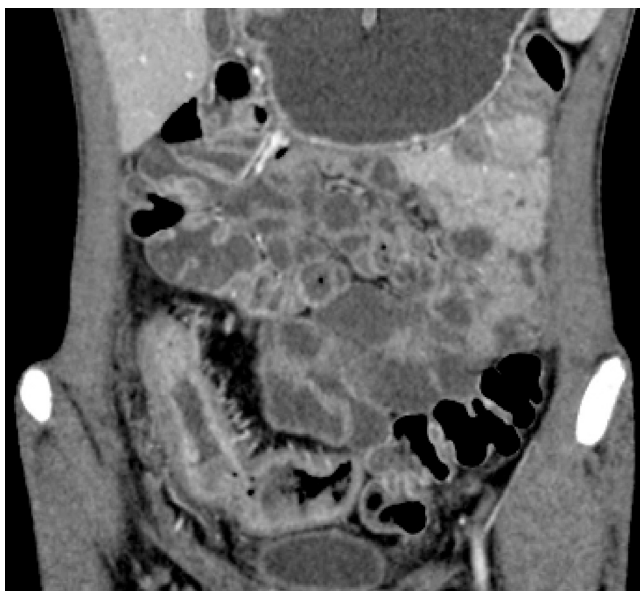
## Method

The study was approved by the Ethics Committee of the Federal University of Mato Grosso do Sul. After reading and signing an informed consent form, patients diagnosed with Crohn's disease referred from Coloproctology Outpatient Clinics of Hospital Universitário Maria Aparecida Pedrossian and Hospital Regional de Mato Grosso do Sul were studied.

Patients diagnosed with Crohn's disease, aged over 18 years, and already evaluated by colonoscopy were included.

Patients with a known gastrointestinal tract neoplasia, patients with gastrointestinal symptoms such as nausea and vomiting, pregnant women, and patients with allergy to iodinated contrast or with creatinine above 2.0 mg/dl were excluded from this study.

All participants responded to a questionnaire (Fig. 1) on Crohn's disease about symptoms and signs at presentation and current medication.



**Fig. 1 – Enterography by computed tomography of abdomen (sagittal section) showing luminal dilation, wall thickening and contrast hyper-uptake.**

Regarding the medication used, these drugs were classified as immunosuppressants (azathioprine), salicylates (oral mesalazine), topical salicylates (mesalazine enemas and suppositories), corticosteroids (prednisone and budesonide), biologicals (infliximab and adalimumab) and antibiotics (metronidazole and ciprofloxacin).

An oral neutral contrast, polyethylene glycol solution (Muvinalx®), commercially available as sachets with 13.125 g, was used as per protocol in the procedures. This product was diluted as follows: five sachets (65.625 g) in 1500 mL of water (43.75 g/L), administered during 40 min. Then, the participants underwent computed tomography (CT) of the abdomen and pelvis. An Aquilon-64 tomograph with 64 rows of detectors (Toshiba Medical Systems, Tokyo, Japan) was used. The examinations were performed with multislice technique and volumetric acquisition, extending from the diaphragm to the pubic symphysis, 65 s after starting the intravenous injection of contrast medium. The contrast was injected at a rate of approximately 3 mL/s in a proportion of 1.5 mL/kg, with a maximum volume of 150 mL. The technical parameters used in CT scans were as follows: collimation  $64 \times 0.625$  mm, pitch = 0.891, 3-mm thick, 120 kVp, and mAs = 1 mm. Coronal and sagittal reconstructions were obtained.

The scans were interpreted by a single radiologist with extensive experience in CT enterography; this professional was blinded to clinical information at his workstation. The evaluator conducted an analysis as to the degree of intestinal distension, divided into four areas of bowel segments: left hypocondrium, mesogastrum, pelvis and terminal ileum. Each region was rated according to a scale from 1 to 3, as follows: 1 – loops <1 cm diameter; 2 – loops with 1–2 cm diameter; 3 – loops >2 cm diameter. Furthermore, the radiologist classified the loop walls as visible or non-visible, also in the four areas considered.

The following findings indicative of disease activity were observed with CT enterography: wall thickening, increased intestinal wall enhancement, parietal stratification, par-enteral fat densification, vascular engorgement (*vasa recta*), lymphadenomegaly, fistulae or abscesses.

Data were analyzed using the Excel Windows® program 2007. The findings of CT enterography were then correlated with the clinical findings obtained through the questionnaire on the disease.

All information on the identity of the research subjects and on questionnaires complied with the ethical principles of research set out in the National Health Council Resolution 466/12.

## Results

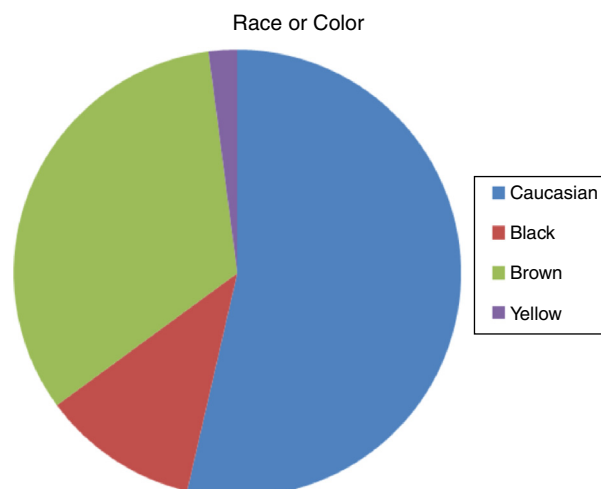
A good tolerance of all patients with oral contrast intake was noted, and all tests have been completed, totaling 34 studies.

Ages ranged from 18 to 67 years (mean, 40 years). Of our 34 patients, 20 (58%) were female and 14 (42%) were male. As for race or color, 18 (52%) reported Caucasian ascend, four (11%) Black, 11 (32%) Brown (2%) and 1 Yellow patient (Fig. 2).

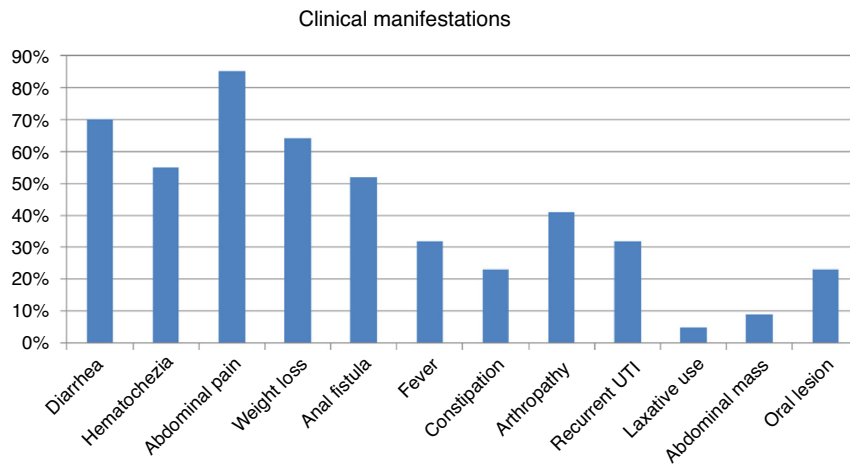
The main clinical manifestations were diarrhea in 24 (70%), hematochezia in 19 (55%), abdominal pain in 29 (85%), and weight loss in 22 (64%) patients (Fig. 3).

Twenty-five patients (73.5%) were under pharmacological treatment. The major drugs used were azathioprine (52%), oral mesalamine (44%) and prednisone (44%), some of these used in combination (Table 1). Nine patients (36%) were using only one drug, especially salicylate (44%), while 13 (38%) were using more than one drug (Table 2).

The main findings of CT enterography were intestinal wall signal enhancement in 23 patients (67%), vascular engorge-ment (*vasa recta*) in 20 (58%), perienteral fat densification in 14 (41%), and bowel wall thickening in 22 (64%) (Table 3 and Figs. 1 and 4). Lymphadenomegaly was observed in 17 (50%) patients. Abscesses were also seen in four (11%) patients, with location on the left ischioanal fossa, at the colostomy site, right



**Fig. 2 – Distribution of patients according to race or ethnicity.**



**Fig. 3 – Signs and symptoms presented by our patients according to the questionnaire applied. Note: some patients presented more than one clinical manifestation.**

**Table 1 – Medication in current use.**

| Drug                   | n  | %  |
|------------------------|----|----|
| Azathioprine           | 13 | 52 |
| Mesalazine tablet      | 11 | 44 |
| Mesalamine suppository | 2  | 8  |
| Mesalazine enema       | 3  | 12 |
| Prednisone             | 11 | 44 |
| Adalimumab             | 4  | 16 |
| Infliximab             | 4  | 16 |
| Ciprofloxacin          | 2  | 8  |
| Metronidazole          | 2  | 8  |

Note: some patients used more than one medication.

**Table 2 – Distribution of patients by drugs used in a monotherapy regimen.**

| Therapy             | n | %   |
|---------------------|---|-----|
| Immunosuppressive   | 2 | 22  |
| Salicylate, topical | 0 | 0   |
| Salicylate, oral    | 4 | 44  |
| Corticoids          | 2 | 22  |
| Biologicals         | 1 | 11  |
| Antibiotics         | 0 | 0   |
| Total               | 9 | 100 |

**Table 3 – Radiological findings of CT enterography.**

| Radiological signs                         | n  | %  |
|--|----|----|
| Intestinal wall enhancement                | 23 | 67 |
| Intestinal wall thickening                 | 22 | 64 |
| Vascular engorgement ( <i>vasa recta</i> ) | 20 | 58 |
| Reactive lymph nodes                       | 17 | 50 |
| Mesenteric fat densification               | 14 | 41 |
| Stenosis                                   | 12 | 35 |
| Target or double halo signal               | 9  | 26 |
| Fistulae                                   | 5  | 14 |
| Abscesses                                  | 4  | 11 |

Note: some studies presented more than one finding.

iliac fossa and in a left extraperitoneal area. The most affected bowel segments were ileum and right colon (Table 4 and Fig. 5).

The combination of perianal lesions in association with urinary tract infection was present in 10 (29%) patients; two (5.8%) were men and eight (23%) were women. Diarrhea and weight loss were observed in 19 (55%) patients.



**Fig. 4 – Enterography by computed tomography of abdomen (coronal section) showing wall thickening, luminal narrowing, “comb” signal and contrast hyper-uptake.**

**Table 4 – Intestinal segments affected found in CT enterography.**

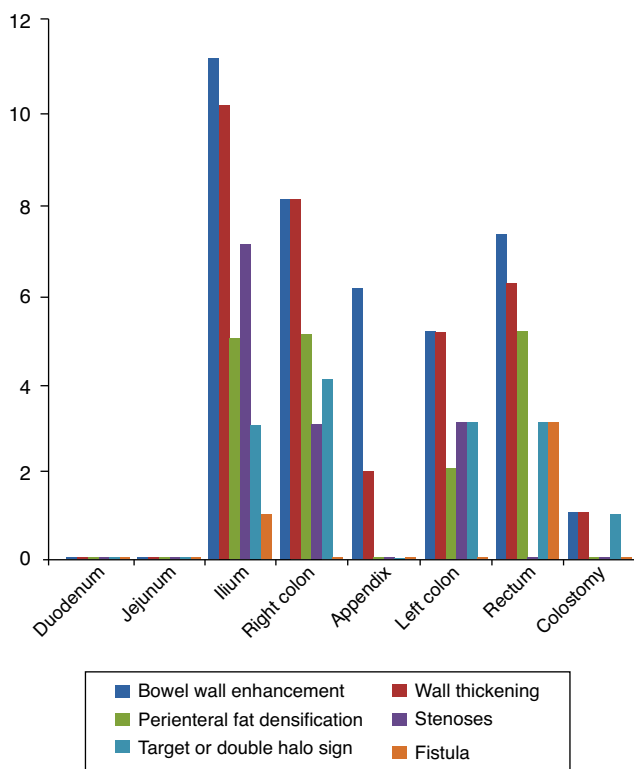
| Intestinal segment | n  | %  |
|--------------------|----|----|
| Duodenum           | 0  | 0  |
| Jejunum            | 0  | 0  |
| Ileum              | 11 | 32 |
| Right colon        | 9  | 26 |
| Appendix           | 5  | 15 |
| Left colon         | 6  | 18 |
| Rectum             | 7  | 21 |
| Colostomy          | 1  | 3  |

Note: some patients presented more than one affected segment.

With the development of imaging studies, the enterography, either by computed tomography or magnetic resonance, is replacing intestinal transit and enteroclysis procedures in the evaluation of the small bowel by imaging procedures. The advantage of CT enterography is that this procedure allows visualization of the entire small intestine, without loop overlapping, and also allows the evaluation of the intestinal wall, detection of extra-luminal pathological conditions, and potential associated changes.

Many of these findings are not seen in traditional endoscopic studies, which supports the progressive replacement of old methods by enterography as the main method of diagnosis for inflammatory bowel disease (IBD).<sup>5-8</sup>

Early studies with CT enterography showed a high degree of sensitivity, above 85%, for the diagnosis of active CD versus barium enteroclysis. Recent studies have demonstrated a



**Fig. 5 – Findings of CT enterography, according to the affected segment. Note: more than one in the same patient were found.**

sensitivity rate of up to 100%, and 53.9% specificity for the identification of CD in its active phase.<sup>7</sup> Other publications have shown that CT enterography is equivalent to MR enterography in the assessment of CD activity.

Despite studies showing good results with CT enterography, there are few publications on this subject in Brazil; thus, it is critical that this study is carried out in our midst.

## Discussion

CT enterography has a clinical application in the evaluation of patients with CD, to confirm the diagnosis of the disease or its extension and complications in the assessment of small bowel.<sup>3</sup> Nowadays, CT enterography constitutes an excellent option for replacement of lower-accuracy radiological methods and as an alternative versus endoscopic capsule, a very expensive technology.

As in other studies,<sup>2</sup> we also observed predominance of female patients (58%), and higher incidence in Caucasians, followed by Brown, Yellow, and Black patients.

In this paper, the sectors most affected by CD lesions were ileum (32%) followed by right colon (26%). If the involvement of cecal appendix (14%) is included, a clear predominance of involvement in the ileocecal transition will be noted, according to the literature. The large intestine was the second most affected area, also according to observations by other authors.<sup>9-11</sup>

The most observed radiological signs in this study were intestinal wall enhancement and thickening, vascular engorgement, reactive lymph nodes, and perienteral fat densification, which is in agreement with the literature, since Costa-Silva et al.<sup>3</sup> and Ilangoan et al.<sup>12</sup> found similar results. Considering that, at its inception, DC usually presents in the inflammatory form, one can really expect that there are large numbers of patients with wall thickening and vascular engorgement. Whereas most of our patients evaluated had recent diagnoses, actually these were the expected findings. In this study, these changes were observed in 88% of patients. Afifi et al.<sup>13</sup> also observed these key findings in patients with active Crohn's disease. Moreover, these authors compared these changes versus surgical evaluation of patients undergoing resection due to CD, and found a good clinical and radiological correlation.

There seems to be no large difference in accuracy when comparing CT enterography versus MR enterography, except that tomography is superior in detecting infectious complications; and for this reason, often this technique is recommended as first choice in the evaluation of the small intestine, immediately after diagnosis, as well as in cases where there is suspicion of abdominal abscesses. In the following reevaluations, maybe there is a greater advantage with the use of resonance, because this technique does not expose the patient to ionizing radiation. In this study, we chose to use CT enterography because this is the procedure available in our environment – a fact that is also observed in most Brazilian medical centers, especially among public tertiary hospitals, where there is a much higher number of tomographs in comparison with magnetic resonance imaging machines.

Perianal lesions associated with urinary tract infection were present in 10 (29%) patients, two (5.8%) men and eight (23%) women. Diarrhea and weight loss were observed in 19 (55%) patients. Such an association may be related to the mal-absorption syndrome observed in CD patients.<sup>2</sup>

Importantly, cross-sectional studies reflect certain moments of the sample; thus, changes may occur in several aspects analyzed over time, and with the inclusion of new patients.

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## Conclusion

The study allows one to observe that the main radiological findings of CT enterography were intestinal wall enhancement and thickening and vascular engorgement, mainly affecting the ileum and right colon. The main clinical manifestations in our patients were diarrhea and abdominal pain.

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## Conflicts of interest

The authors declare no conflicts of interest.

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