Enterography CT without and with water enema in patients with Crohn's disease in comparison with endoscopy

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Purpose

CT is nowadays an examination routinely performed in Crohn's disease (CD) patients. However, there are several ways to assess gastro-intestinal tract, in particular colonic segments.

Aim of this study is to compare enterography-CT performed after oral administration of polyethylene-glycol solution (PEG-CT) versus enterography-CT performed also with water enema via rectum (ECT-WE) in patients with CD.

Material and Methods

PATIENTS

79 patients (39 men and 40 women; age range 18–75 years, mean 45 years) with previous histological diagnosis of Crohn's disease, have performed lower endoscopy within 15 days before the CT so were selected for the study.

CT TECHNIQUE

- CT was performed using 16 or 64-row multidetector CT (Light Speed Pro 16, GE Medical System; Light Speed VCT 64, GE Medical System).
- *Small bowel distension* was obtained with oral administration of 2.0 L of PEG, administered in equal doses of 100 ml starting 30-35 minutes before the CT exam. In ECT-WE the patients also obtained colon distension by warm water enema (1-2 L).

Material and Methods

CT TECHNIQUE

- Administration of 20 mg of an *anticholinergic compound* (N-butyl-hyoscine bromide, Buscopan, Boehringer Ingelheim) just before the CT scan in patients studied by PEG-CT or before colonic distension in patients studied by ECT-WE.
- Contrast-enhanced CT images were acquired 75 seconds after i.v. injection of 130-150 mL *contrast agent* (Ultravist 370, Schering AG, Berlin, Germany): 40-50 ml at a rate of 1 mL/sec followed from a bolus of 80-90 ml at a rate of 3 ml/sec. The I.V. administration of contrast agents was done to evaluate the pattern and extent of wall pathological enhancement.

Material and Methods

CT criteria for diagnosis of bowel disease: *parietal thickening*.

Imaging analysis:

- density (H.U.), grade (mm) and symmetry of the parietal thickening
- presence of associate extraluminal anomalies.

Material and Methods: CT

- diameter of bowel lumen (diameter of the loop excluding the thickness of the wall)
- diameter of the loop (diameter of the loop including the thickness of the wall)
- presence of stenosis
- presence, site and number of abnormal altered bowel segments
- degree of mural thickening
- presence of target sign (alternating rings of high and low density)

Imaging analysis

Material and Methods: CT

- comb sign (hypervascularity of the involved mesentery)
- presence of polyps
- perienteric stranding (loss of the normal sharp interface between the bowel wall and mesentery)
- fibrofatty proliferation (excess of mesenteric fat)
- lymphadenopathy (diameter > 1 cm)
- abscesses and fluid in abdomen
- fistulas, sinus tract (linear extension from small bowel loop into an exoenteric inflammatory process)

Imaging analysis

Material and Methods: CT

Bowel distension

- The *distension* of each bowel segment was classified in a four-point scale (0= absent, 1= incomplete, 2=partial, 3= complete).
- In all patients we evaluated the *discomfort* from infusion of contrast medium by mouth and/or by rectum. The evaluation was performed by a patient questionnaire: presence and degree of abdominal pain (from 0=no pain, to 3 maximum pain), presence of nausea and vomiting.

Material and Methods

ENDOSCOPY

Lower endoscopy was performed as requested for clinical indication and following bowel preparation according to the Intestinal Bowel Disease (IBD) center where patients were admitted.

Results

37/79 (47%) patients were studied by ECT-WE and 42/79 (53%) by PEG-CT.

During the exams, presence and degree of abdominal pain were significantly higher in patients undergone to ECT-WE compared to PEG-CT (p: 0.005) (Table 1). No statistically significant difference was present for vomiting or nausea between the two groups.

	Pain		Nausea		Vomiting	
	PEG-CT n°pt (%)	ECT-WE n°pt (%)	PEG-CT n°pt (%)	ECT-WE n°pt (%)	PEG-CT n°pt (%)	ECT-WE n°pt (%)
No	22 (52)	8 (21,5)	6 (14)	4 (11)	38 (90,5)	33 (89)
Yes	20 (48)	29 (78.5)	36 (86)	33 (89)	4 (9.5)	4 (11)
P value	**0.005**		0.643		0.850	

Table 1. Presence of discomfort

Results

ECT-WE was associated to greater colonic distension compared to PEG-CT. The different degrees of distension of the loops (classified with a four-point scale) are summarized in Table 2.

	0 absent*		1 incomplete*		2 partial*		3 complete*		p-value
	PEG-CT	ECT-WE	PEG-CT	ECT-WE	PEG-CT	ECT-WE	PEG-CT	ECT-WE	
PJ	6 (13,5)	2 (5)	8 (20)	2 (5)	11 (26,5)	5 (13)	17 (40)	28 (77)	0.0018
DJ	3 (6.5)	1 (2,5)	6 (13,5)	1 (2,5)	8 (20)	3 (7,5)	25 (60)	32 (87,5)	0.0078
PI	1 (2.5)	1 (2,5)	3 (6,5)	1 (2,5)	6 (13,5)	3 (7,5)	32 (77,5)	32 (87,5)	0.2559
DI	1 (2,5)	0 (0)	2 (5.5)	1 (3)	3 (6,5)	2 (6)	36 (85,5)	34 (91)	0.3730
LIL	1 (2,5)	1 (3)	2 (5,5)	1 (3)	5 (12)	1 (3)	34 (80)	34 (91)	0.1858
RC	12 (28)	0 (0)	3 (7)	1 (3)	18 (43)	1 (3)	9 (22)	35 (95)	**<0.001**
TrC	22 (52,5)	0 (0)	9 (21,5)	1 (3)	8 (19)	1 (3)	3 (7)	35 (94)	**<0.001**
LC	17 (40)	0 (0)	12 (29)	0 (0)	11 (26)	1 (3)	2 (5)	36 (97)	**<0.001**
SC	19 (45)	0 (0)	7 (17)	0 (0)	11 (26)	1 (3)	5 (12)	36 (97)	**<0.001**
Re	19 (45)	0 (0)	12 (29)	0 (0)	11 (26)	0 (0)	0 (0)	37 (100)	**<0.001**
Overall	101 (24.1)	5 (1.3)	64 (15.2)	8 (2.2)	92 (21.9)	18 (4.9)	163 (38.8)	339 (91.6)	**<0.001**

Table 2. Degree of bowel loop's distension in CT

*Results are present as number of patients with corresponding percentage in parentheses

PJ proximal jejunum; *DJ* distal jejunum; *PI* proximal ileum; *DI* distal ileum; *LIL* last ileal loop; RC: right colon; TrC: transverse colon; LC: left colon; SC: sigmoid colon; Re: rectum

Results

The judgment given independently by different gastro-intestinal radiologists displayed an agreement higher than 90%. Distension of colon, sigmoid colon and rectum was found to be significantly better in patients studied with ECT-WE than those studied with PEG-CT ($p<0.001$) (Fig 1) while no other significant differences were found for other sites.

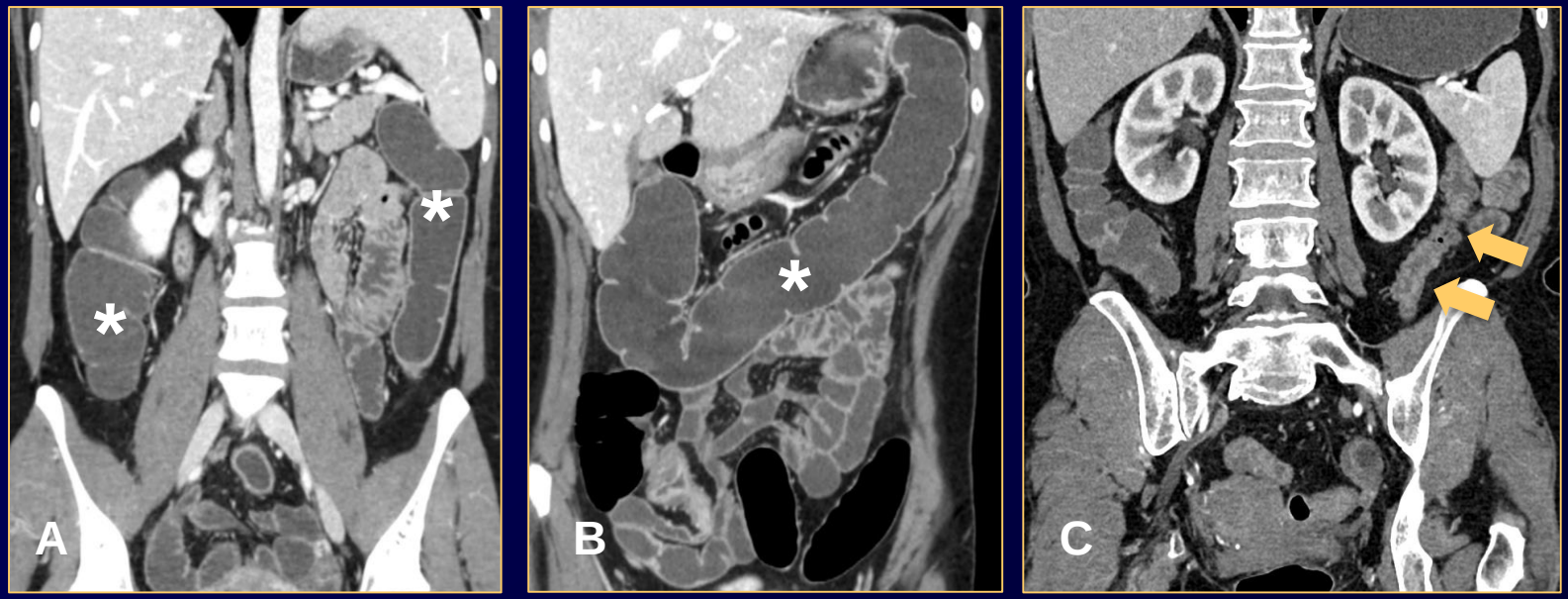

Fig 1. ECT-WE (A, B) shows a good distension of the colon (asterics); incomplete distension of the colon is evident in this patient studied with PEG-CT (C), especially of the left colon (arrows).

Moreover, overall distension was found to be significantly better in patients studied with ECT-WE than those studied with PEG-CT ($p<0.001$).

Results

The site of involved segments is described in the table 3.

Table 3

site of pathological loops	PEG-CT number patients (%)	ECT-WE number patients (%)
duodenum	1 (2)	0
proximal jejunum	0 (0)	0
distal jejunum	2 (5)	0
proximal ileum	3 (7)	3 (8)
distal ileum	11 (26)	5 (13,5)
last ileal loop	16 (38)	10 (27)
caecum-ascending colon	11 (26)	4 (11)
transverse colon	13 (31)	6 (16)
descending colon	12 (28)	12 (32)
sigmoid colon	12 (28)	11 (30)
Rectum	8 (19)	10 (27)

Results: CT findings

Colonic localizations

We found 100 pathological loops, 57 in PEG-CT and 43 in ECT-WE.

CT findings of the pathological loops are described in Table 4.

		PEG-CT (42 pz)	ECT-WE (37 pz)
Number of thickened large bowel loops		57	43
Mean thickness (mm)		4,95 (±4.07)	3,60 (±4.26)
Mean lumen diameter (mm)		4,75 (±5.89)	6,69 (±8.90)
Mean longitudinal extension (mm)		93,25	87,2
Stenosis		57	43
Target sign		47	40
Polyps		0	4
Comb sign		35	25
Perienteric stranding		8	8
Sinus tract		2	1
Fibro-fatty proliferation		5	4
Number of patients with fistulas		6	5
Number of patients with abscess		3	3
Number of patients with lymph nodes (diameter > 1 cm)		12	9
Number of patients with fluid in abdomen		7	3

Table 4

Results

Endoscopy was used as gold standard for colonic mucosa assessment (Fig. 2).

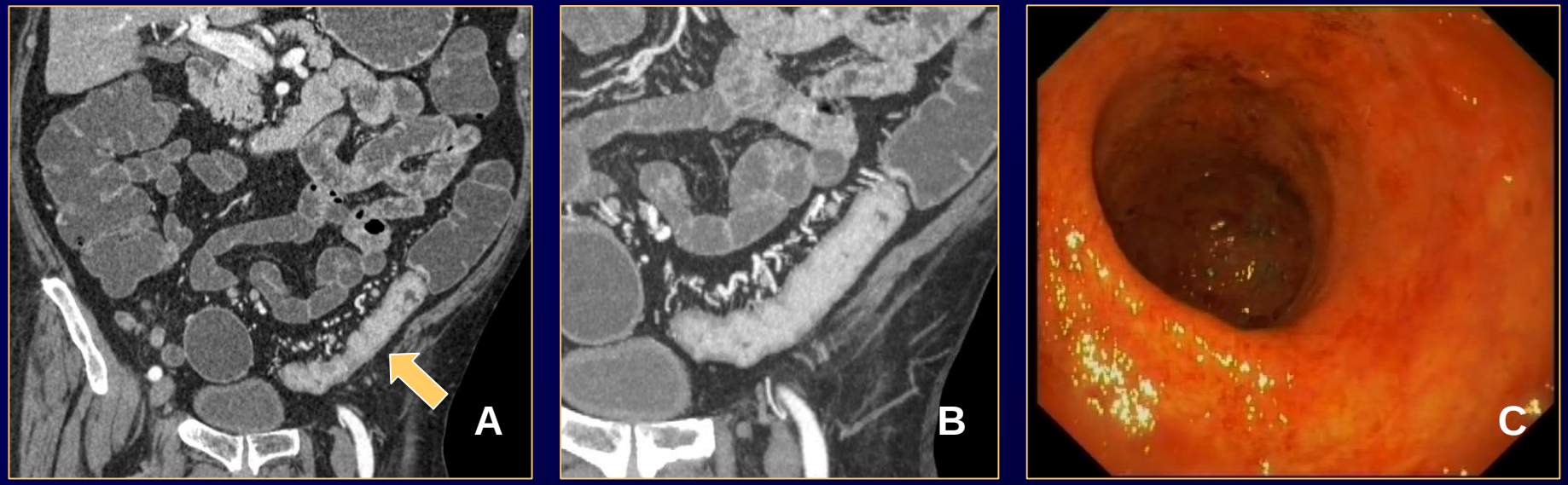

Fig 2. Coronal ECT-WE (A) shows mural thickening with target sign and comb sign of the left colon (arrow), better showed in coronal-MIP reconstruction (B); endoscopy (C) shows mucosal alterations with erosions.

Results

Endoscopy was used as gold standard for colonic mucosa assessment (Fig. 3).

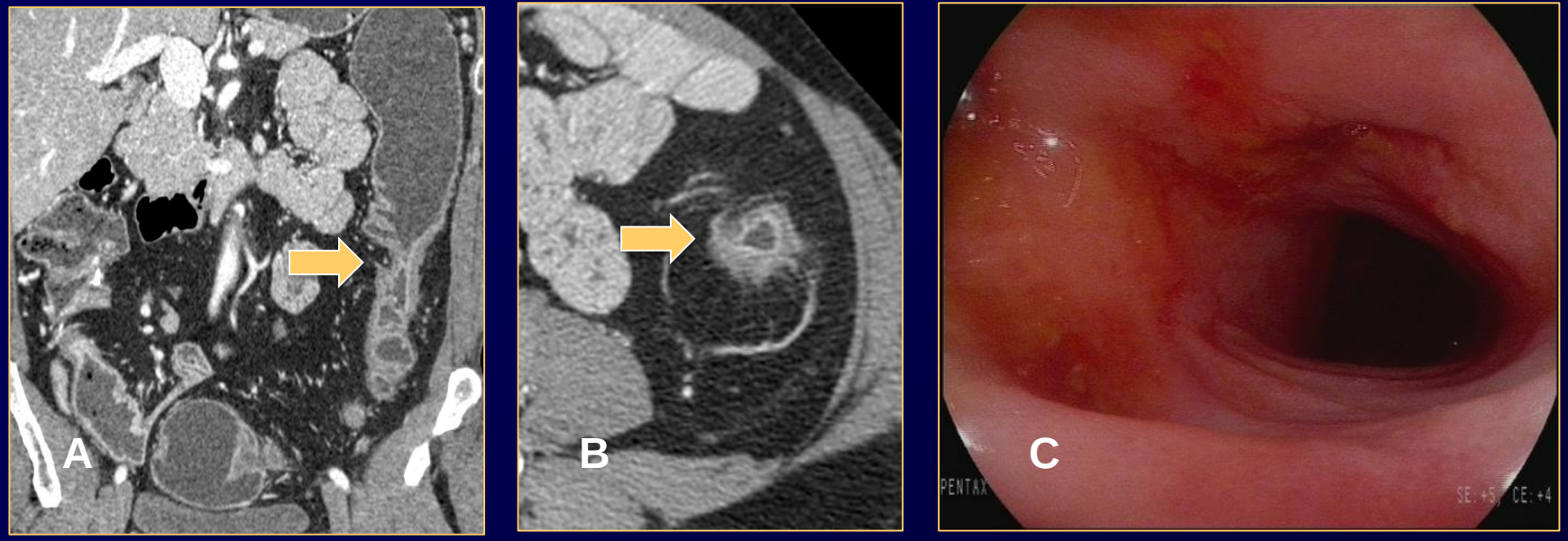

Fig 3. ECT-WE in coronal (A) and axial (B) planes shows stenosis of the left colon (arrows) with target sign and fibrofatty proliferation. Endoscopy (C) shows linear deep ulcer in left colon.

Results

Endoscopy was also used to set false positive cases of the CT (Fig 4)

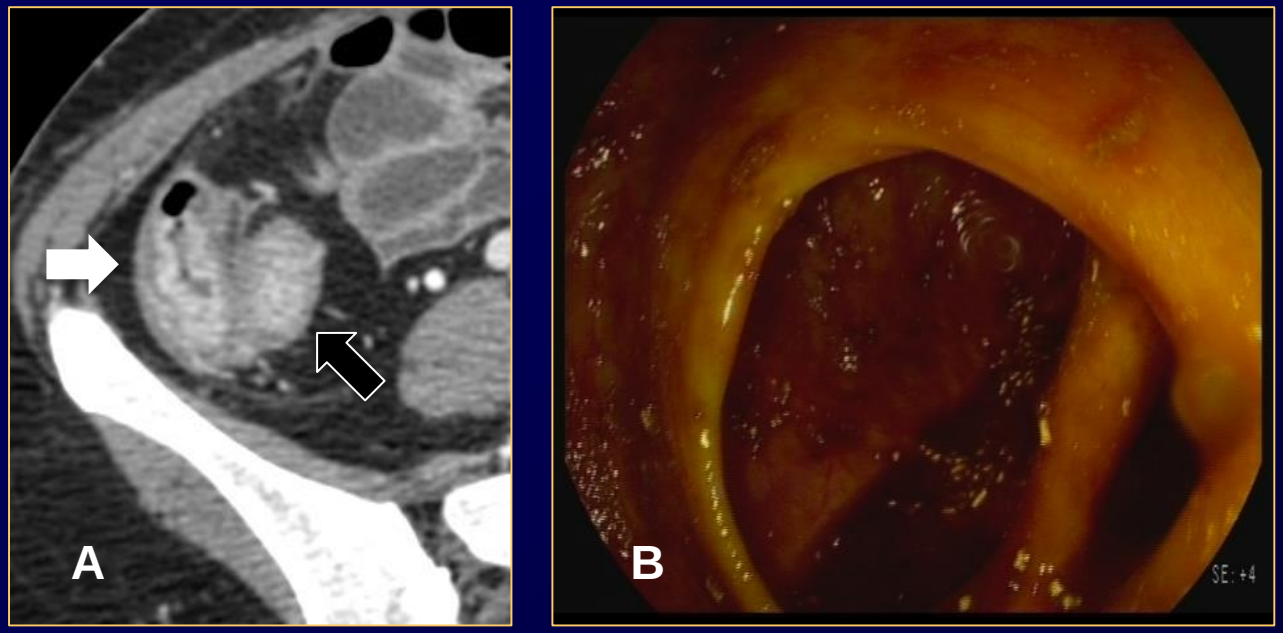

Fig 4. PEG-CT (A) shows thickening of the cecum (white arrow); thickening of the last ileal loop is also evident in the image (black arrow). Endoscopy shows no alteration in the colon (B) and confirms ileal loop alteration (not shown)

Results

Endoscopy was also used to set false false negative cases of the CT (Fig 5)

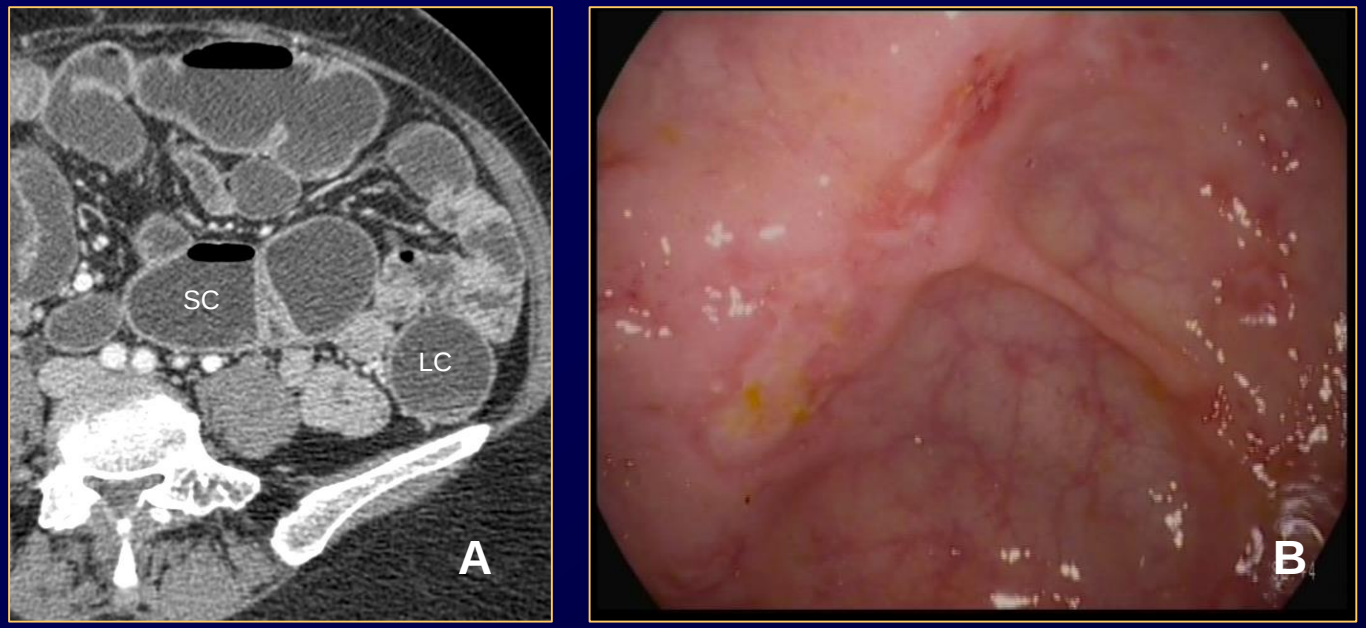

Fig 5. ECT-WE (A) shows no alterations in the colon (SC: sigmoid colon, LC: left colon). Endoscopy (B) shows presence of ulcers in the left colon

Results

In comparison with endoscopy values of sensitivity, specificity and diagnostic accuracy were respectively:

- 77%, 86.5% and 81% in patients studied with PEG-CT
- 89%, 100% and 92% in patients studied with ECT-WE (Table 5).

	PEG-TC 42 patients	ECT-WE 37 patients
True positive (TP)	21	25
False positive (FP)	2	0
True negative (TN)	13	9
False negative (FN)	6	3
Sensitivity (TP/TP+FN)	77% (95% CI: 57.7%-91.4%)	89% (95% CI: 71.8%-97.7%)
Specificity (TN/TN+FP)	86,5% (95% CI: 59.5%-98.3%)	100% (95% CI: 66.4%-100.0%)
Diagnostic accuracy (TP+TN/tot)	81%	92%

Table 5. Diagnostic accuracy of CT

Conclusions

- ECT-WE allows to evaluate large bowel as well as small bowel so ECT-WE should be preferred to ECT to assess both the small and large bowel in a single examination.
- The advantages of CT over MR imaging include greater availability, higher spatial resolution and the ability to simultaneously depict bowel wall inflammation, extra-enteric complications, and abdominal organs in shorter examination times.

Conclusions

- Moreover, CT is a technique that requires ionizing radiation. Another limitation of ECT- WE is patient's discomfort and the time needed for all procedures.
- In our hospital, endoscopy with biopsy and CT are often the first exams in patients with suspected Crohn's disease to confirm or exclude diagnosis, while MRI is usually performed in patients with Crohn's disease after or during medical therapy, particularly in young patients. We can contemplate to perform ECT-WE in follow-up of selected patients and in those patients with an incomplete colonscopy.