



Alimentary Tract

## Value of cross-sectional imaging in assessing active Crohn's disease before stoma reversal



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### ABSTRACT

**Background:** There are currently no guidelines on the need to assess disease activity before stoma reversal in Crohn's disease (CD). We sought to determine the value of cross-sectional imaging for detecting active CD before stoma reversal.

**Methods:** 38 CD patients underwent cross-sectional imaging before stoma reversal. CD activity was blindly evaluated by an independent radiologist. Postoperative outcomes were recorded.

**Results:** Before stoma reversal, cross-sectional imaging identified active CD in 20 of the 38 study participants (52.6%). In 9 out of 10 tested patients, radiologic and endoscopic assessments gave concordant findings with regard to CD recurrence before stoma reversal. Stoma reversal was delayed in half of the patients with active CD and in none of the patients without active CD. Before stoma reversal, tumor necrosis factor alpha antagonists or immunosuppressants were initiated in 45% of the patients with active CD and 5.6% of the patients without active CD. In the year following stoma reversal, the recurrence rate (in a radiologic assessment) was higher in patients with active CD than in patients without active CD (75.0% vs. 30.8%, respectively;  $p = 0.04$ ).

**Conclusion:** Cross-sectional imaging revealed postoperative recurrence in about a quarter of patients before stoma reversal; this finding may influence the postoperative treatment strategy and outcomes.

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## 1. Introduction

Crohn's disease (CD) is a chronic, progressive, disabling, destructive condition [1,2]. About half of patients with CD will require surgery within ten years of diagnosis [1–5]. The need for surgery appears to have decreased following the marketing authorization of immunosuppressants and tumor necrosis factor (TNF)-alpha antagonists for the indication of CD [6–8]. When a patient has several risk factors for postoperative complications (such as intra-abdominal septic complications), a temporary diversion stoma is usually created [9–12]. The stoma is closed when the patient's gen-

eral condition has improved—usually three months after complete nutritional recovery [9]. However, surgery for CD is not curative, and the postoperative recurrence of lesions is frequent [3,4,13–16]. Ileocolonoscopy is recommended as the gold standard for the diagnosis of postoperative recurrence in the year following surgery [3].

Over the recent years, cross-sectional imaging has emerged as a valuable tool for the diagnosis and follow-up of CD. Cross-sectional imaging allows the assessment of both mural and extramural disease, as well as the detection and staging of CD lesions (inflammation, penetrating complications and obstructive disease) [17–24]. Recent evidence shows that cross-sectional imaging techniques may also be able to detect the postoperative recurrence of CD [25–28].

In some patients who require a temporary stoma, CD may recur in the time interval between surgery and stoma reversal—even though recurrence after anastomosis is most frequent [29–31]. This potentially increases the morbidity associated with stoma

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reversal. Surprisingly, there are currently no guidelines on the need to assess CD recurrence before stoma reversal. Hence, the primary objective of the present study was to define the value of a systematic cross-sectional imaging for detecting active CD before stoma reversal. We also sought to (i) identify the proportion of patients with CD recurrence, and (ii) assess patient management and outcomes as a function of the radiologic assessment.

## 2. Methods

### 2.1. Patients

We performed a retrospective, single-center study at Nancy University Medical Center (Nancy, France). All the adult CD patients followed in the Nancy IBD Cohort [32–34] were screened for inclusion. We included all those having undergone (i) surgical treatment with a temporary fecal diversion between January 2011 and December 2015, and (ii) cross-sectional imaging assessment (with magnetic resonance imaging (MRI) or computed tomography (CT)) before stoma reversal. The patients' demographical, clinical (Montreal Classification [35]) and surgical characteristics were recorded. We also reviewed the radiologic and endoscopic findings before index surgery and before stoma reversal, and the postoperative outcomes (including complications, radiologic and/or endoscopic assessments, and treatments).

In line with current French legislation on retrospective studies, the Nancy IBD Cohort [32–34] database is registered with the French National Data Protection Commission (*Commission Nationale de l'Informatique et des Libertés*, reference 81404720).

### 2.2. Indications for temporary stoma (index surgery)

A temporary stoma was implemented according to the presence or absence of risk factors for postoperative septic complications [9–11,36–38]. These factors included poor nutritional status, intra-abdominal abscess, preoperative steroid use, recurrent clinical episodes of CD, emergency surgery, bowel obstruction, and the presence of inflammation at the resection margins.

Poor nutritional status was defined as an albumin level <35 g/L and/or a body mass index (BMI) <18.5 kg/m<sup>2</sup> and/or weight loss >5% per month. Septic conditions were defined as the presence of several fistula tracts, abscesses and peritonitis. Preoperative steroid therapy was considered to be a risk factor when the patient has been taking a prednisone equivalent dose of 20 mg or more for at least three months before the index surgery. Emergency surgery was defined as surgery performed within three days of hospital admission. Bowel obstruction was defined radiologically. The presence of inflammation at the resection margins was determined macroscopically by the surgeon.

### 2.3. Assessment before stoma reversal

The cross-sectional imaging assessment of CD activity before stoma reversal was usually performed three months after the index surgery. Magnetic resonance enterography (MRE) was performed after oral administration of a mannitol solution, with T1-, T2- and diffusion-weighted sequences and intravenous gadolinium contrast [21]. The procedure for MRI colonography was the same as for MRE, except for the bowel preparation [39]. Computed tomography enterography (CTE) was performed after oral administration of a mannitol solution and intravenous injection of contrast medium [21]. Standard CT was not preceded by bowel preparation. Some patients had also undergone ileocolonoscopy under general anesthesia at the time of the radiologic assessment.

### 2.4. Cross-sectional imaging

An independent radiologist (VL) from the Nancy University Medical Center blindly reviewed all the radiologic datasets. Active CD lesions were rated according to the Nancy Score [39]. Three or four bowel segments were defined for each patient: the intraperitoneal segment upstream of the stoma, the intraperitoneal segment downstream of the stoma, and (depending on the stoma type) one or two intraparietal segments (i.e. short digestive segments that cross the abdominal wall). Six radiologic signs were assessed for each segment: diffusion-weighted imaging hyperintensity, rapid gadolinium enhancement after administration of intravenous contrast medium, differentiation between the mucosa–submucosa complex and the muscularis propria, bowel wall thickening, parietal edema, and the presence of one or more areas of ulceration (Supplementary Table 1). The presence or absence of each sign was rated as “1” or “0”, respectively, and a segmental Nancy Score from 0 to 6 was calculated for each segment. Active CD was defined by a segmental Nancy Score >2 in at least one segment. If the segmental Nancy Score was exactly 2, the radiologist decided whether active CD was present (sometimes with regard to how easy the 6 radiologic signs were to assess). The overall Nancy Score was defined as the mean of the segmental scores.

The difference between CD recurrence and CD persistence after surgery (i.e. CD lesions that were not removed during surgery) in the digestive segment upstream of the stoma was defined with regard to the presence or absence of these lesions at the last radiologic or endoscopic assessment before index surgery. The difference between persistent CD activity after surgery and diversion lesions in the digestive segment downstream of the stoma was defined with regard to the presence or absence of these lesions before index surgery.

### 2.5. Postoperative complications

Postoperative complications that occurred within 30 days of stoma reversal were graded according to the Clavien–Dindo Classification [40]: fistula recurrence, collections or hematoma were considered to be grade I or II complications; collections drained using a radiologic or surgical technique in the absence of general anesthesia were considered to be grade IIIa complications; and anastomotic leakage or volvulus requiring surgery under general anesthesia were considered to be grade IIIb complications.

### 2.6. Postoperative assessment

Postoperative radiologic and/or endoscopic assessments were performed within 12 months of stoma reversal. Endoscopic postoperative recurrence was defined as a Rutgeerts' score  $\geq 2$  [14]. Radiologic postoperative recurrence was defined as the presence of inflammation, stenosis or fistula; a disease activity score was not systematically applied for this assessment.

### 2.7. Statistical analysis

The statistical analysis was carried out using the SAS<sup>®</sup> software (version 9.4, SAS Institute, Inc., Cary, NC, USA). Categorical variables were described as the number (percentage) and absolute count. Continuous variables were described as the mean  $\pm$  standard deviation (SD), median [interquartile range], and range. Fisher's exact test was used to compare categorical variables. Student's test was used to compare continuous variables. The threshold for statistical significance was set to  $p < 0.05$ .

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