A Scoring System to Determine Patients' Risk of Colectomy Within 1 Year After Hospital Admission for Acute Severe Ulcerative Colitis Short title: Predictors of colectomy in patients with ASUC

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Short title: Predictors of colectomy in patients with ASUC

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Abbreviations used in this paper: ulcerative colitis: UC; ASUC: Acute severe ulcerative colitis; tumor necrosis factor blockers: anti-TNFs; Inflammatory bowel disease: IBD; C-reactive protein: CRP; Clostridioides difficile infection: CDI; inflammatory bowel disease unclassified: IBDU; Cytomegalovirus: CMV; interquartile ranges: IQR; 95% confident interval: 95%CI; WCC: white cell count

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Abstract

Background & Aims: There is consensus on the criteria used to define acute severe ulcerative colitis (ASUC) and on patient management, but it has been a challenge to identify patients at risk for colectomy based on data collected at hospital admission. We aimed to develop a system to determine patients' risk of colectomy within 1 y of hospital admission for ASUC based on clinical, biomarker, and endoscopy data.

Methods: We performed a retrospective analysis of consecutive patients with ASUC treated with corticosteroids, ciclosporin, or tumor necrosis factor (TNF) antagonists and admitted to 2 hospitals in France from 2002 through 2017. Patients were followed until colectomy or loss of follow up. A total of 270 patients with ASUC were included in the final analysis, with a median follow-up time of 30 months (derivation cohort). Independent risk factors identified by Cox multivariate analysis were used to develop a system to identify patients at risk for colectomy 1 y after ASUC. We developed a scoring system based on these 4 factors (1 point for each item) identify high-risk (score 3 or 4) vs low-risk (score 0) patients. We validated this system using data from an independent cohort of 185 patients with ASUC treated from 2006 through 2017 at 2 centers in France.

Results: In the derivation cohort, the cumulative risk of colectomy was 12.3% (95% CI, 8.6–16.8). Based on multivariate analysis, previous treatment with TNF antagonists or thiopurines (hazard ratio [HR], 3.86; 95% CI, 1.82–8.18), Clostridioides difficile infection (HR, 3.73; 95% CI, 1.11–12.55), serum level of C-reactive protein above 30 mg/L (HR, 3.06; 95% CI, 1.11–8.43), and serum level of albumin below 30 g/L (HR, 2.67; 95% CI, 1.20–5.92) were associated with increased risk of colectomy. In the derivation cohort, the cumulative risks of colectomy within 1 y in patients with scores of 0, 1, 2, 3, or 4 were 0.0%, 9.4% (95% CI, 4.3%–16.7%), 10.6% (95% CI, 5.6%–17.4%), 51.2% (95% CI, 26.6%–71.3%), and 100%. Negative predictive values ranged from 87% (95% CI, 82%–91%) to 92% (95% CI, 88%–95.0%). Findings from the validation cohort were consistent with findings from the derivation cohort.

Conclusion: We developed a scoring system to identify patients at low-risk vs high-risk for colectomy within 1 y of hospitalization for ASUC, based on previous treatment with TNF antagonists or thiopurines, C difficile infection, and serum levels of CRP and albumin. The system was validated in an external cohort.

Key words: Ulcerative colitis, acute severe colitis, colectomy, predictors

WHAT YOU NEED TO KNOW

Background: It has been a challenge to identify patients with acute severe ulcerative colitis (ASUC) at risk for colectomy within the next year based on data collected at hospital admission.

Findings: We identified 4 factors associated with increased risk of colectomy within 1 y after hospital admission (previous treatment with tumor necrosis factor antagonists or thiopurines, Clostridioides difficile infection, increased serum level of C-reactive protein, decreased serum level of albumin). We used this information to develop a scoring system that identified patients at high-risk vs low-risk for colectomy, and validated it in an external cohort.

Implications for patient care: This scoring system can be used to identify patients at low risk of colectomy at 1 year (score 0) who can make an early transition to oral therapy and be discharged from the hospital, and patients at high-risk (scores of 3 or 4) who should be carefully monitored.

Introduction

Acute severe ulcerative colitis (ASUC) affects approximately 25% of patients with ulcerative colitis (UC) [1]. This complication is well defined by Truelove and Witts criteria as well as the therapeutic management after hospital admission [2]. Medical treatment notably intravenous corticosteroids, ciclosporin, and tumor necrosis factor blockers (anti-TNFs) have changed the prognosis of ASUC. However, colectomy is still required in a substantial subgroup of patients. Predictors of colectomy are needed in clinical practice, since morbidity, mortality and costs increase with the duration of hospitalization before colectomy [3–5]. Several predictive scores of colectomy in patients with ASUC have been already described [6], and include clinical and/or biological parameters, notably albumin or C-reactive protein (CRP) level. Although they are strongly associated with the response to corticosteroids [7], several points limit their use in clinical practice. They were established before the era of biologics and are generally calculated on day 3 after admission. Moreover, some critical items, such as the presence of *Clostridioides difficile* infection (CDI) are not included [8,9]. Nevertheless, none was created to foresee patients with a low risk of colectomy to allow decreased monitoring. Two recent studies have identified CRP / albumin ratio as a good predictor of colectomy over the medium to long term [10,11]. One recent review concludes that new scoring systems are required to predict response to treatment and colectomy [6]. The aims of our study were to identify predictive factors, among clinical, biological, endoscopic, and radiological criteria and to perform a new score assessing the probability of colectomy during the first year after ASUC.

Methods

Patients

A derivation cohort was created by reviewing medical files of consecutive patients with UC, defined by European consensus criteria [2], or inflammatory bowel disease unclassified (IBDU) (whose diagnosis remained unclassified at the end of follow-up), hospitalized in emergency for IBD flare between 2002 and 2017 at Saint–Antoine Hospital, Paris and between 2008 and 2017 at Caen University hospital, and treated with intravenous corticosteroids, ciclosporin, or anti-TNFs. In case of

recurrence of ASUC during follow-up, only the first episode was considered. Patients with Crohn's disease at the time of hospital admission or during follow-up, and patients without information on albumin and CRP levels at admission were excluded. Date of cohort entry was the date of hospital admission for ASUC. Patients were followed until April 31th, 2018, or at last news including loss to follow-up, colectomy or death, whichever occurred first. Secondly, an independent cohort including all consecutive patients with an ASUC treated between 2006 and 2017 from two French centers, Kremlin Bicetre hospital and Henri Mondor hospital, was built for external validation. Inclusion criteria were similar between the two cohorts and data were independently collected in each cohort.

Therapeutic management

Patient hospitalized for ASUC were treated according to standard guidelines [12]. In case of absence of response after 3 to 5 days of corticosteroids, options for colectomy, ciclosporin or anti-TNFs as a salvage medical therapy were considered. *Cytomegalovirus* (CMV) infection was confirmed by presence of inclusion body in histopathological examination and testing for CDI was systematic at admission in our centers.

Data collection

Variables were collected at Saint Antoine hospital from the SUVIMIC registry (a prospective clinical database of all patients with IBD evaluated by Saint-Antoine Hospital digestive disease medical staff), endoscopic and medical records, and collected at Caen University hospital from medical records.

The following variables were collected at cohort entry: age, gender, IBD type (UC or IBDU), comorbidities according to the Charlson's index [13], previous appendicectomy, date of IBD diagnosis, disease extent defined by Montreal classification [2], and previous treatment exposure, including thiopurines and anti-TNFs. Clinical variables, such as Truelove and Witts criteria [14] or Clinical activity index [15], the number of stools, extra-intestinal manifestations, date of the onset of symptoms and the used of oral corticosteroids before admission were analyzed. We recorded biological data (hemoglobin, albumin, C-reactive protein, white cells count, and platelet count) and microbiological data (CDI and histological signs of CMV

infection), that were obtained during the first full day following admission. Radiological (disease extent) and endoscopic (Mayo endoscopic score, mucosal damage) variables were collected from original reports at the start of hospitalization. Then, treatment exposures during hospitalization were assessed: drug classes (aminosalicylates, corticosteroids, thiopurines, ciclosporin and anti-TNFs), date of introduction and withdrawal, and therapy at hospital discharge, including colectomy. During follow-up, occurrences of treatment modifications for IBD, hospitalizations, and colectomy were assessed. In the validation cohort, collected data were: age, previous treatment exposure, including thiopurines and anti-TNFs, albumin and C-reactive protein levels, CDI, occurrence of colectomy, and date of last visit.

Outcomes

The primary outcome was the occurrence of colectomy within one year after hospital admission. The secondary outcomes included response to corticosteroids, need for rescue therapy and occurrence of colectomy, and were assessed at hospital discharge and end of follow-up.

Statistical analyses

Continuous data are presented as medians and interquartile ranges (IQR) and were compared with a Wilcoxon–Mann–Whitney test. Categorical variables were summarized as frequencies with percentages and compared with a Chi-square or Fisher's test. Cumulative risk of colectomy was assessed in the whole cohort. Cox regression was used to assess the relationship between clinical, biological and endoscopic variables with the risk of colectomy within one year. Variables with a P values below than 0.10 at univariate analysis were included in multivariate analysis. Sensitivity analysis was performed by excluding patients with IBDU.

According to the coefficient estimates in the multivariate Cox regression analysis, we built a prognostic score. To assess the quality of the prognostic score, patients were classified as having a low, intermediate or high probability of colectomy. Percentages (95% confident interval [95%CI]) of colectomy depending on the calculated score were estimated from 1000 bootstrapped samples of 270 patients (uniform selection with replacement) [16]. In the validation cohort, cumulative risk of colectomy at one year was assessed according to the developed score. P values <0.05 were

considered statistically significant. The study was approved by the Saint-Antoine Hospital ethics committee for the both centers (N°2014-A01788-39). Statistical analyses were performed using SAS (version 9.4, Inc, Cary, NC, USA) and R (version 3.4.2, R Foundation for Statistical Computing, Vienna, Austria).

Results

Derivation cohort

Baseline characteristics

In the derivation cohort, 421 patients with UC or IBDU were hospitalized and screened. Of these, 270 patients were included in the analysis (Figure 1). Baseline characteristics are presented in Table 1. Thirty percent (81/270) of the patients were previously exposed to thiopurines. Among the 34 patients exposed to anti-TNFs before cohort entry, 7 had discontinued anti-TNFs before admission index, due to severe skin side effects (1), allergic reactions (2), serious infections (1), primary failure (1), remission (1), and nonadherence (1). Among patients with no missing data to assess the clinical activity index (Lichtiger index) and Truelove and Witts criteria (n=215, 80% of the total cohort), 83.2% had a clinical activity index above 10 and 75.2% had an ASUC defined by Truelove and Witts criteria. CRP level above 30mg/L, and albumin level below 30g/L were observed in 64.8% (175/270) and 44.4% (120/270) of patients, respectively. Endoscopy was performed in 241 patients (89.2%) and an abdominal CT scan in 70 patients (25.9%) (Supplementary table 1).

Therapeutic Management

Before admission index, 121 patients (45%) were treated with oral corticosteroids. Among them, 71 had no response to corticosteroids and 40 had a recurrence of symptoms during the decrease of corticosteroids. The first line treatment after hospital admission was intravenous corticosteroids in 94.1% (n=254) of patients, infliximab in 3.7% (n=10), ciclosporin in 1.5% (n=4), and adalimumab in 0.7% (2 patients, who failed to response to oral corticosteroids and infliximab during the last year prior to admission). Thirty-nine percent of patient treated with corticosteroids (n=98) needed a 2nd line therapy. Among non–responders to the first line (38%, 102 patients, in any treatment group), 7%, 65%, 25%, and 3% were treated with colectomy, infliximab, ciclosporin, or other treatments (adalimumab or

golimumab), respectively. The rate of response to infliximab and ciclosporin was 91% and 85%, respectively. Only 4 patients had a third medical line of treatment. Colectomy was performed in 4.8% (n=13) of patients during the hospitalization after a median duration of 15 days (IQR: 8–19). No patients died during hospitalization.

Long term follow-up

Median time of follow-up was 30 months (IQR: 7–66). One patient died during the follow-up related to a cholangiocarcinoma. Forty-three percent of patients (n=83) were hospitalized for flare during the first year following ASUC. The cumulative risk of colectomy according to the time since the index hospitalization is shown in the figure 2. Colectomy was performed in 30 (12.3%), 43 (20.1%) and 47 (33.3%) at 1, 5, and 10 years after the index hospitalization, respectively. Among patients with missing data at admission about Lichtiger Index and Truelove and Witts criteria, no difference was observed on the rate of colectomy at one year (9% versus 11,6% in patients with available data, p=0.77).

Predictors of colectomy at one year

By univariate analysis, patients with colectomy at one year were significantly older at diagnosis of IBD (Table 2). Previous treatment with thiopurines or anti-TNFs were associated with an increased risk of colectomy (Table 2). Considering previous treatment with thiopurines or anti-TNFs, hazard ratio was 2.4 (95%CI 1.19–5.00, p=0.01). Among patients with no missing data, clinical activity index was not associated with an increased risk of colectomy (HR: 1.07, 95%CI 0.93–1.22, p=0.36). Regarding biological parameters, presence of *CDI*, CRP level above 30 mg/L and serum albumin level below 30 g/L measured during the first day following admission were predictors (Table 2). By multivariate analysis, four criteria were significantly associated with an increased risk of colectomy within one year after admission: previous treatment with anti-TNFs or thiopurines (HR: 3.86; 95%CI, 1.82–8.18), presence of *CDI* (HR: 3.73; 95%CI, 1.11–12.55), CRP level above 30 mg/L (HR: 3.06; 95%CI, 1.11–8.43), and albumin level below 30 g/L (HR: 2.67; 95%CI, 1.20–5.92). Results were consistent after exclusion of patients with IBDU. Results were consistent across centers.

We developed a prognostic score based on these four predictors. Since the β-coefficients of the Cox multivariate regression analysis varied around 1.19 between 0.98 and 1.35, the same weight for all variables was chosen to simplify: 1 point for each item, from 0 to 4. Forty-one patients (15.2%) had no criteria, 91 patients (33.7%) had one criteria, 113 (41.8%) patients had 2 criteria, 24 patients (8.9%) had 3 criteria and one patient (0.4%) had 4 criteria. The cumulative risk of colectomy within one year in patients with a score of 0, 1, 2, 3 and 4 items at admission was respectively 0.0%, 9.4% (95%CI 4.3–16.7), 10.6% (95%CI 5.6–17.4), 51.2% (95%CI 26.6–71.3), and 100% (Figure 3 and 4). Colectomy was performed during hospitalization in the patient with 4 criteria. Characteristics of the score are presented in table 3. The negative predictive value varied between 87% (95%CI 82–91) and 92% (95%CI 88–95). The positive predictive value (PPV) increased gradually according to the score 1, 2, 3, 4 (respectively 9%, 10%, 42% and 100%). As estimated with the 95%CI from the bootstrap method, the percentage of patient with a low (score=0; n=41 (IQR: 30–53)), intermediate (score=1 or 2; n=204 (IQR: 192–217)) and high score (score=3 or 4; n=25 (IQR: 16–34)) was respectively 0.0 (0.0–0.0), 9.9 (5.7–14.2) and 53.3 (30.7–74.9).

Validation cohort

In the validation cohort, 185 patients were included (100 and 85 from Kremlin Bicetre hospital and Henri Mondor hospital, respectively), with a median age at admission of 38.0 (IQR: 25-51) and 35.6% (66/185) were previously exposed to anti-TNFs or thiopurines. Median CRP and albumin levels were respectively 48.5mg/L (IQR: 20.2-117.0) and 29.9g/L (IQR: 25.0-35.0). CRP above 30mg/L, albumin below 30g/L and CDI were observed in 65.9% (122/185), 49.7% (92/185) and 5.4% (10/185) of patients, respectively. Seven patients were lost to follow-up before one year. The cumulative risk of colectomy within one year was 21.6% (95%CI:15.9-27.9). In this cohort, cumulative probability of colectomy according to the score 0, 1, 2, 3, 4 at admission were respectively 6.2% (95%CI:0.4-25.5) (1/17), 8.4% (95%CI:3.4-16.4) (6/71), 29.4% (95%CI:19.3-40.3) (21/74), 50% (95%CI:26.3-69.8) (10/21), and 50% (95%CI:0.0-96.0) (1/2) (Figure 4 and Supplementary data 2), which is consistent with findings from the derivation cohort among patients with a score of 0 (low-risk profile) and score 3-4 (high-risk profile). The patient with a score of 0 and who underwent colectomy during hospitalization was 68 years old and had, besides

no response to intravenous CS, a known low grade colonic dysplasia and a latent *Mycobacterium tuberculosis* infection.

Discussion

Among data on hospital admission of 270 unselected patients with ASUC, 4 predictors of colectomy within one year have been identified: previous treatment with anti-TNFs or thiopurines, presence of *CDI*, CRP level above 30 mg/L and albumin level below 30 g/L. We combined the variables into a score, which is highly predictive of having a colectomy or not within one year after admission. Results were consistent in the validation cohort for low- and high-risk profile patients.

Our population is similar to others studies, notably regarding clinical and biological characteristics [17–19]. The rate of *CDI* (4.3%) is homogenous with recent studies [20]. Corticosteroid therapy for ASUC was the cornerstone of first-line treatment in our study (94.0%) as previous studies [21], and the overall response rate to corticosteroids in our cohort (61%) was similar with the literature [22]. Despite no difference was reported regarding efficacy and short-term safety between infliximab and ciclosporin in the two randomized controlled trials [19,24], a higher proportion of patient were treated with infliximab (65%) compared to ciclosporin (25%) in our study. This may be related to the substantial proportion of patients previously exposed to thiopurines and thus not eligible for ciclosporin, and also related to physician preferences, as reported in previous studies [12,23]. We observed a high response to infliximab (91%) and ciclosporin (85%), compared to a meta-analysis of non-randomized studies (respectively, 74.8% and 55.4%) [23]. However, these rates of response are similar to the CySIF study, which observe at day 7 86% of response to ciclosporin and 84% to infliximab [24]. Since the response rate of the second line therapy was higher, the percentage of colectomy during hospitalization (4.8%) was lower compared to that of literature, which is usually ranging from 11% to 25% [18,25,26]. After one year of follow-up, probability of colectomy (12.3%) was nevertheless close to recent studies (12%) [18].

Four criteria at admission were associated with colectomy within one year after ASUC in multivariate analysis. First, previous exposure to anti-TNFs or thiopurines was predictive of colectomy. Two studies have already reported a strong association between colectomy and previous exposure to immunosuppressants [25,27]. None

reported an association with anti-TNFs, which may be related to the period of inclusion. Second, *CDI* is a well-known predictor, especially for the long term risk (OR: 2.96; 95% CI: 1.19–7.34) but not for the short term risk [8,9]. Third, a level of albumin below 30 g/L was already included in previous scores [10,28]. Lastly, CRP level, which is also a marker of inflammation, was associated with colectomy in historical cohorts [29,30].

From these 4 items, a predictive score of colectomy has been developed. Firstly, an internal validation was performed with bootstrapping technique. Secondly, a validation cohort was built to assess external validation. Results were consistent in the validation cohort for low- and high-risk profile patients. When no criterion is present, the risk of colectomy at one year is minimal (0% to 6%), allowing an early transition to oral therapy and discharge from hospital. When one or two criteria are identified, 10 to 30% of patients will be operated within one year. Among patients with a score of 2, discrepancies were observed between derivation and validation cohorts was observed about the score 2 (10.6% (95%CI: 5.6-17.4) versus 29.4% (95%CI: 19.3-40.3)). A potential residual confounding cannot be excluded, but this difference may be also related to the physician preference. Indeed, patients with this score range are at intermediate risk, among whom physicians preference may have the highest impact on colectomy occurrence in this area of uncertainty. Further studies are required to assess the impact of referent physician preference on the decision of colectomy. Among patients with a score greater than three, the risk is higher and colectomy may be discussed earlier, decreasing the morbi–mortality of surgery. PPV is similar with those observed in an English cohort published by Lynch *et al.* [7].

The score developed in this study has several strengths: it is easy to use because only four items are included, with one point for each, improving the reproducibility between physicians and could be widely used. Since it is assessed at the first day of hospitalization, it can help physicians early in the therapeutic management. Previous treatments with anti-TNFs or thiopurines and *CDI* have been included for the first time in a predictive score of colectomy after ASUC.

Some limitations need to be discussed. Radiological and endoscopic criteria were too often lacking to be included in the analysis. Xie *et al.* have shown a higher

performance of the UCEIS to predict colectomy after a median follow - up of 73 months than the mayo endoscopic score [31]. The number of Truelove and Witts criteria and the clinical activity index were not available for all patients. The later was nevertheless not predictive of colectomy in several studies [32,33] and *Lindgren et al.* had also included patients with moderately severe flare according to Truelove and Witts criteria [29]. Fecal calprotectin seems to have a predictive value in ASUC, but it was not routinely measured in our centers [6,34]. Moreover, we focused on colectomy after ASUC, but, nowadays, it would be interesting to have predictors of others issues such as mucosal healing, or success of specific biologics or small molecules [35]. Further studies are required to identify these predictors.

To conclude, in this exploratory cohort of consecutive patients with ASUC, four independent predictors of colectomy within one year were identified: previous treatment with anti-TNFs or thiopurines, presence of *CDI*, CRP level above 30 mg/L, and albumin level below 30 g/L. A score combining these predictors is highly predictive of the occurrence and risk magnitude of colectomy within one year after admission and a replicative cohort confirmed these results.

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Table 1: Characteristic at admission (Derivation cohort)

Characteristic	N total=270
Demographic parameters	
Male	134 (49.6)
Age at admission, year	32.0 (24.0–47.0)
At least one item in Charlson's score	41 (15.2)
Duration of disease, year	2.0 (0.0–7.0)
ASUC within 6 months after diagnosis	80 (29.6)
Disease	
Ulcerative colitis	260 (96.3)
IBDU	10 (3.7)
Extension of disease	
Extensive colitis	162 (60)
Left sided colitis	101 (37.4)
Proctitis	7 (2.6)
Previously exposed to anti-TNFs or thiopurines (past and current users)	88 (32.6)
Clinical parameters	
Number of stools per day	10.0 (7.0–15.0)
Lichtiger index*	12.0 (10.0–14.0)
Extra-intestinal manifestation	31 (11.9)
Biological parameters	
CRP, mg/L	53.0 (18.6–110)
Albumin, g/L	30.7 (26.3–35.5)
Hemoglobin, g/dL	11.6 (10.1–13.2)
WCC (x 10^9 per L)	9.9 (7.56–13.0)
Platelet (x 10^9 per L)	388 (305 - 479)
CMV colitis	5 (5.8)
CDI, n (%)	10 (4.3)

Results are expressed as median (interquartile range) for continuous variables and as N (%) for categorical variables.

* Among 215 patients with no missing data to assess the clinical activity index (Lichtiger index)

ASUC: Acute severe ulcerative colitis; IBDU: Inflammatory bowel disease unclassified; CRP: C-reactive protein; WCC: white cell count; CMV: cytomegalovirus; CDI: *Clostridioides difficile* infection

Table 2: Clinical and biochemical variables of 270 patients admitted with ASUC (Derivation cohort)

	Colectomy at one year (n=30)	No colectomy at one year (n=240)	Hazard ratio (95%CI)	p
Clinical variables				
Male	16 (53.3)	118 (49.2)	0.86 (0.42–1.76)	0.68
Charlson's index	0 (0–1)	0 (0–0)	1.18 (0.93–1.52)	0.18
Previous appendectomy	3 (10)	9 (3.8)	2.70 (0.82–8.89)	0.10
Age at diagnosis (years)	37.0 (25.0–47.0)	26.0 (21.0–40.0)	1.03 (1.01–1.05)	<0.01
Age at admission above 50 (years)	10 (33. 3)	49 (20.4)	1.90 (0.89–4.06)	0.10
Disease duration (years)	2 (0.0–7.0)	2 (0.0–7.0)	0.99 (0.94–1.04)	0.75
ASUC onset within 6 months after diagnosis	4 (13.3)	76 (31.7)	0.35 (0.12–0.99)	0.048
Extensive colitis (E3) (vs E2 + E1)	23 (77)	139 (58)	2.21 (0.9–5.2)	0.07
Medication before admission:				
Thiopurines	14 (46.7)	67 (27.9)	2.09 (1.02–4.27)	0.04
Anti-TNFs	9 (30)	34 (12.6)	3.17 (1.45–6.93)	<0.01
Time of flare–up before admission	33.0 (20.0–75.0)	31.0 (16.0–56.0)	1.00 (0.99–1.00)	0.55
Oral steroids before admission to treat flare–up	17 (56.7)	104 (43.5)	1.57 (0.76–3.23)	0.22
Number of stools	10.0 (7.0–15.0)	10.0 (6.0–15.0)	1.03 (0.99–1.08)	0.15
Extra-intestinal manifestation	2 (6.9)	29 (12.5) (29)	0.54 (0.13- 2.28)	0.40
Biochemical variables				
CRP above 30 mg/L	25 (83.3)	150 (62.5)	2.84 (1.09–7.43)	0.03
Albumin below 30 g/L	20 (66.7)	100 (41.7)	2.60 (1.22–5.56)	<0.01
Hemoglobin (g/dL) *	10.8 (9.80–12.2)	11.8 (10.2–13.3)	0.88 (0.75–1.03)	0.12
WCC (x 10^9 per L) **	9.32 (7.1–13.0)	9.9 (7.6–13.0)	1.00 (1.0–1.0)	0.44
Platelet (x 10^9 per L) ***	395 (328–495)	388 (299–479)	1.00 (0.99–1.00)	0.52
Presence of *C. difficile* infection	3 (13.0)	7 (3.4)	3.83 (1.16–12.62)	0.03
CMV colitis	2 (18.2)	3 (4.0)	4.32 (0.93–20.07)	0.06

ASUC: Acute severe ulcerative colitis; WCC: white cell count; CRP: C-reactive protein; CMV: Cytomegalovirus; Risk corresponding to an increase of one unit (*), 1000 WCC/mm^3 (**) and 10 000 platelet (***)

Table 3: Characteristics of score one year after admission for ASUC from derivation cohort

	Negative predictive value (NPV) (%) (95%CI)	***Positive predictive value (PPV) (%) (95%CI)***	***Sensitivity (%) (95%CI)***	***Specificity (%) (95%CI)***
Score=0	87 (82–91)	-	-	83 (78–87)
Score=1	88 (82–92)	9 (4–17)	27 (12–46)	65 (59–71)
Score=2	88 (82–93)	10 (5–17)	37 (20–56)	58 (51–64)
Score=3	92 (88–95)	42 (22–63)	33 (17–53)	94 (90–97)
Score=4	89 (85–93)	100 (3–100)	3 (0–17)	100 (98–100)

Figures and caption:

Figure 1: Flow chart of study (Derivation cohort)

IBD: Inflammatory bowel disease; CRP: C-reactive protein

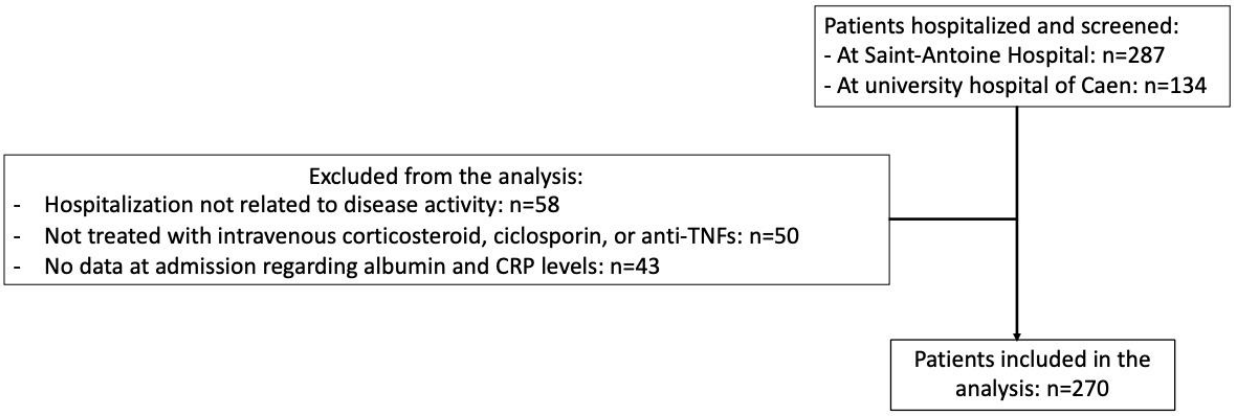
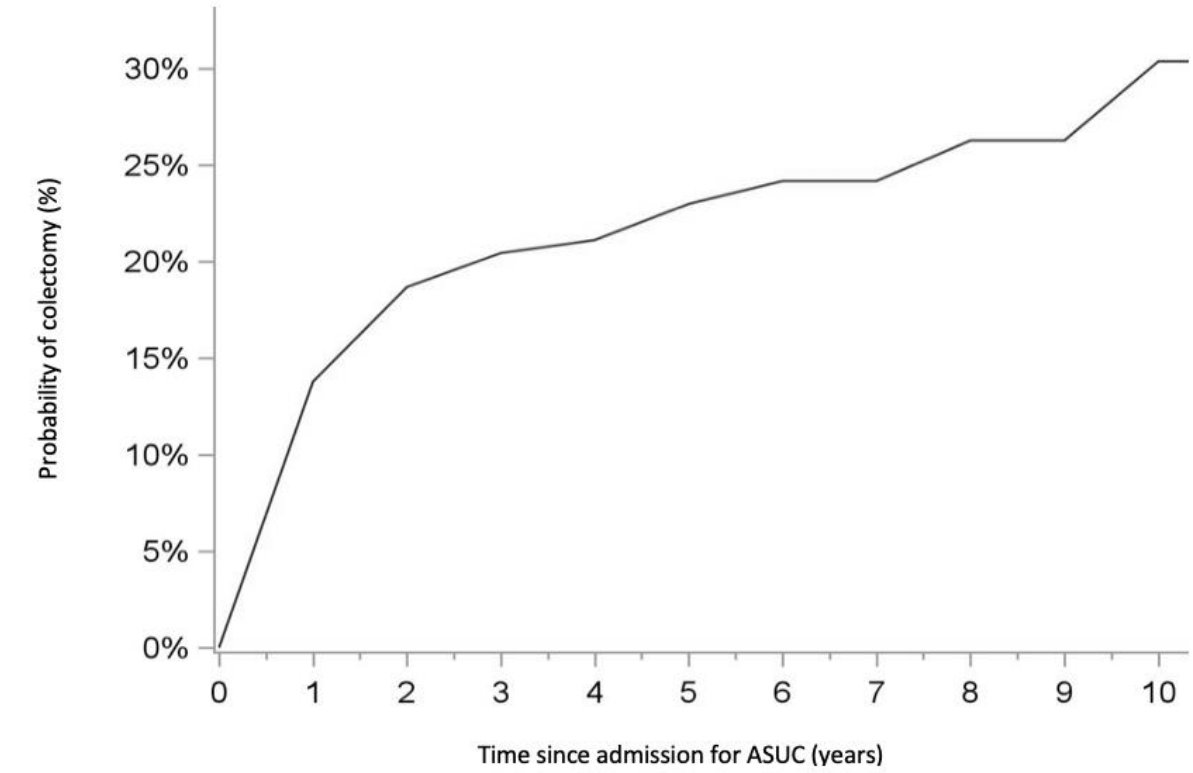
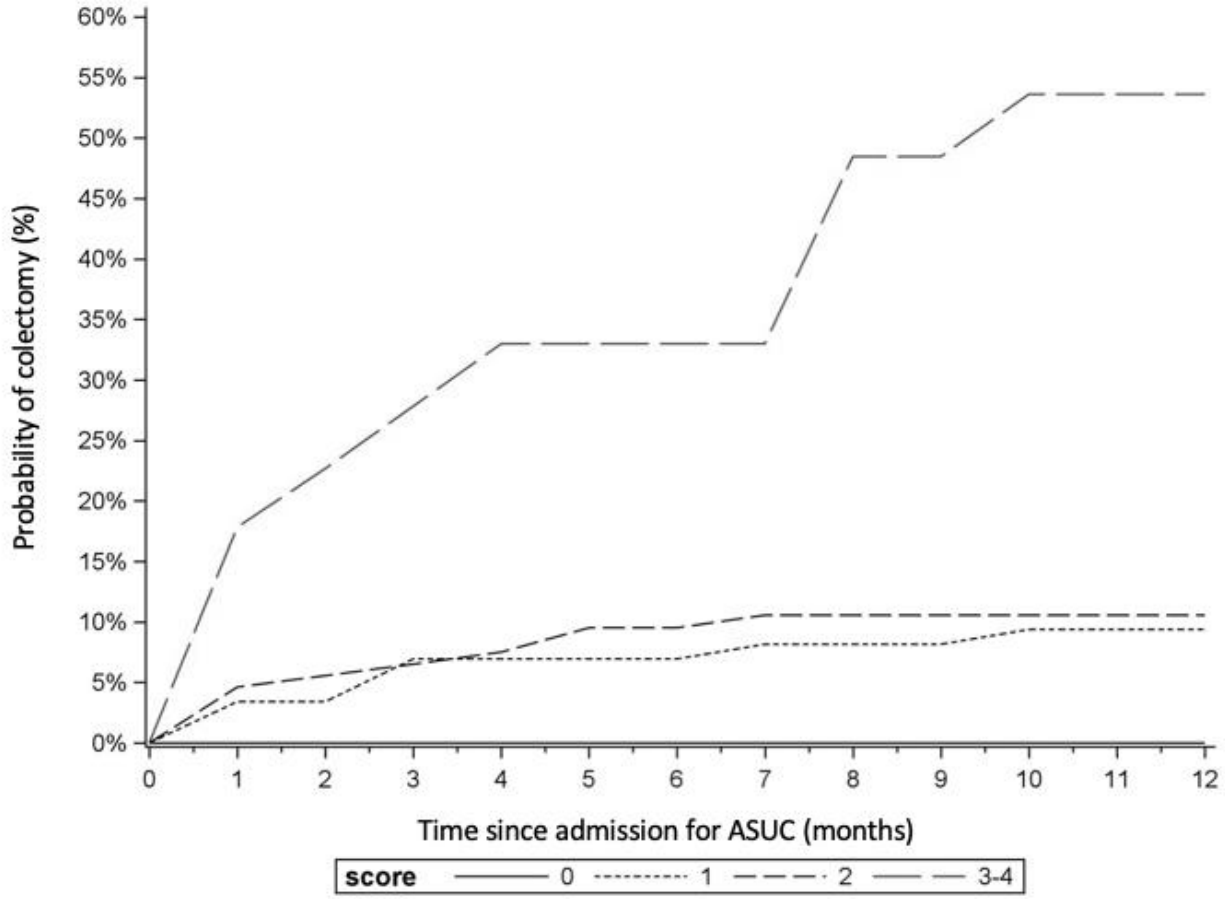


Figure 2: Rate of colectomy according to the time since admission for ASUC (Derivation cohort)



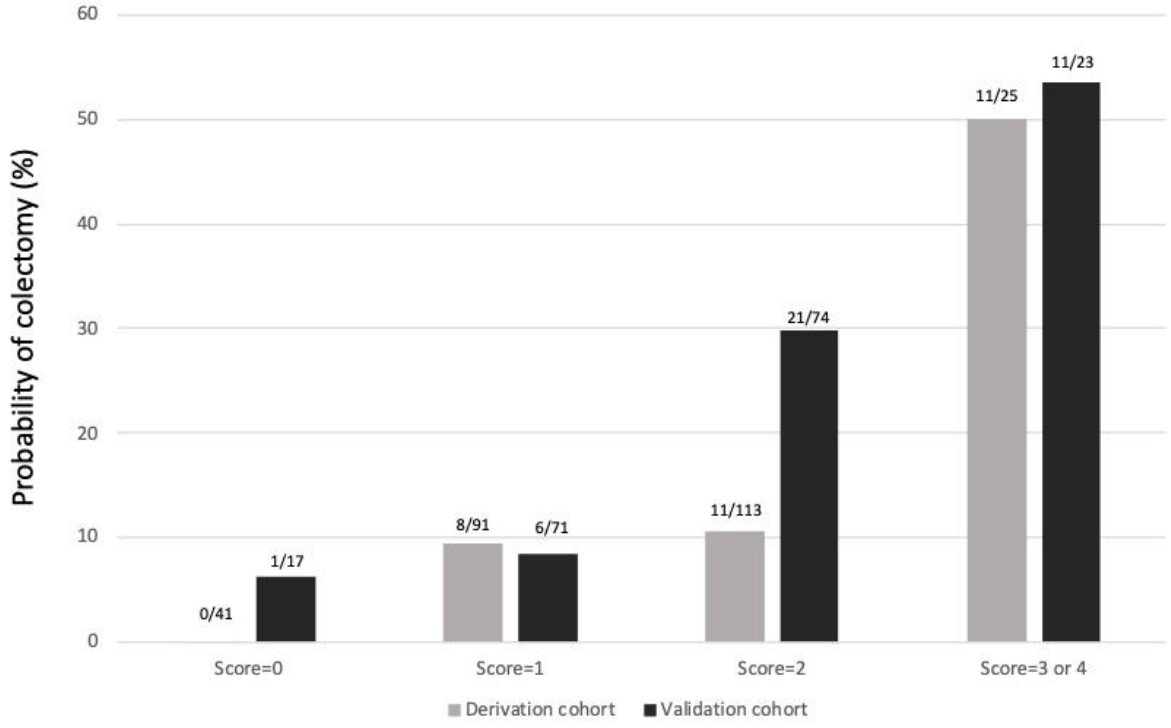
At risk	270	192	154	126	109	80	59	49	34	25	9
Colectomy	0	30	38	40	41	43	44	44	45	45	47

Figure 3: Cumulative probability of colectomy according to the time since admission for ASUC (Derivation cohort)



Score=0	41	34	34	34	33	33	31	31	30	30	30	30	30
Score=1	91	82	82	78	78	78	77	75	75	75	74	74	74
Score=2	113	101	100	97	93	90	89	86	86	83	82	81	81
Score=3 - 4	25	17	16	14	13	13	13	13	10	10	9	9	0

Figure 4: Risk of colectomy within one year after an ASUC according to the predictive score in the derivation and validation cohorts.



Derivation cohort	0.0	9.4 (4.3–16.7)	10.6 (5.6–17.4)	51.2 (26.6–71.3)
Validation cohort	6.2 (0.4-25.5)	8.4 (3.4-16.4)	29.4 (19.3-40.3)	50.0 (27.4-69.0)

% (95%CI)

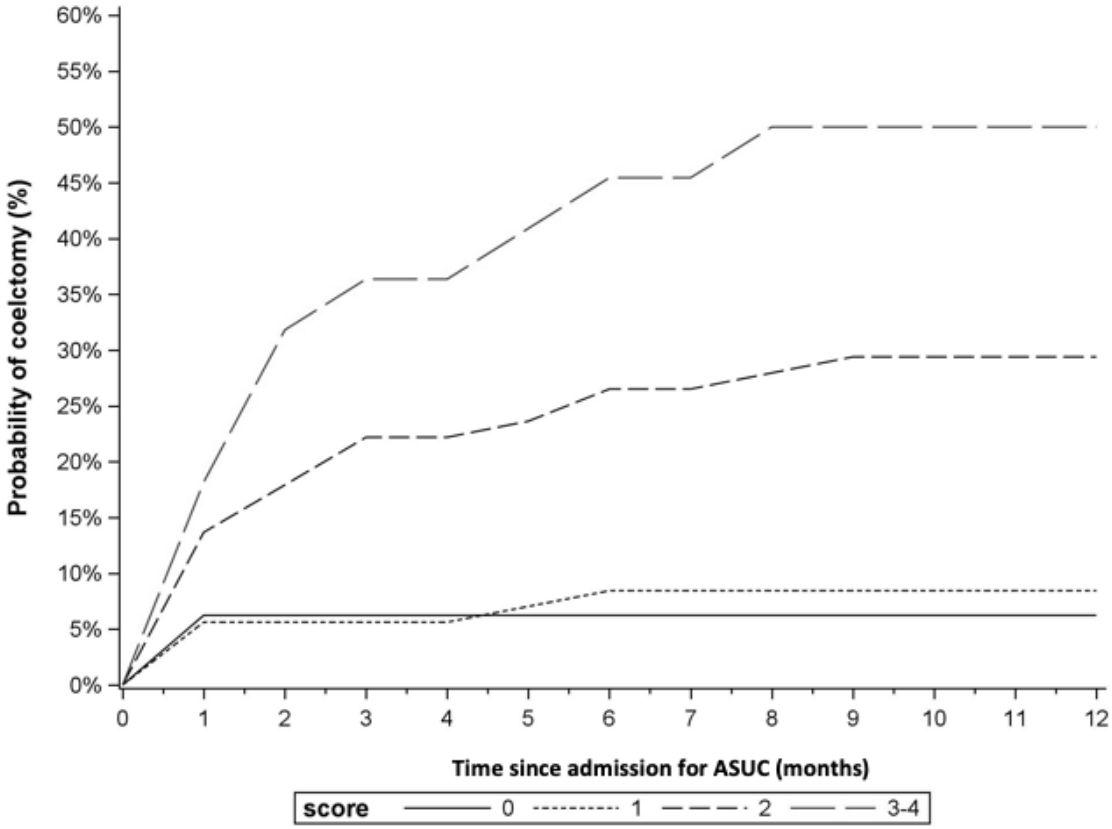
Supplementary data 1: Endoscopic and radiological criteria at admission

	Colectomy at one year (n=30) N (%) or median (IQR)	No colectomy at one year (n=240) N (%) or median (IQR)
Endoscopic criteria*		
Mayo endoscopic score:		
Mayo 1	4.0 (1)	13.0 (27)
Mayo 2	20.0 (5)	21.7 (45)
Mayo 3	76.0 (19)	65.2 (135)
Mucosal damage:		
None	4.3 (1)	7.3 (13)
Erosions	13.0 (3)	20.8 (37)
Superficial ulcer	34.8 (8)	40.4 (72)
Deep ulcer	47.8 (11)	31.5 (56)
Radiological criteria**		
Disease extent on CT–scan:		
Left–sided	8.3 (1)	35.1 (20)
Pancolitis	91.7 (11)	64.9 (37)

* Among 241 patients with no missing data about endoscopic criteria

** Among 70 patients with no missing data about radiological criteria

Supplementary data 2: Cumulative probability of colectomy according to the time since admission for ASUC and to the score in the validation cohort



Score=0	17	15	15	15	15	15	15	15	15	15	15	15	15
Score=1	71	67	67	67	67	66	65	65	65	65	65	65	65
Score=2	74	61	58	54	54	53	51	51	50	49	48	48	48
Score=3 - 4	23	18	15	14	14	13	12	12	11	11	11	11	11