Ultrasound Characteristics Can Predict Response to Biologics Therapy in Stricturing Crohn's Disease

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INTRODUCTION: **Stricture is a common complication in Crohn's disease (CD). Accurate identification of strictures that poorly respond to biologic therapy is essential for making optimal therapeutic decisions. The aim of this study was to determine the association between ultrasound characteristics of strictures and their therapeutic outcomes.**

METHODS: **Consecutive CD patients with symptomatic strictures scheduled for biologic therapy were retrospectively recruited at a tertiary hospital. Baseline intestinal ultrasound was conducted to assess stricture characteristics, including bowel wall thickness, length, stratification, vascularity, and creeping fat wrapping angle. Patients were followed up for a minimum of 1 year, during which long-term outcomes including surgery, steroid-free clinical remission, and mucosal healing were recorded. Statistical analyses were performed.**

RESULTS: **A total of 43 patients were enrolled. Strictures were located in the ileocecal region (39.5%), colon (37.2%), anastomosis (20.9%), and small intestine (2.3%). The median follow-up time was 17 months (interquartile range 7–25), with 27 patients (62.8%) undergoing surgery. On multivariant analysis, creeping fat wrapping angle > 180° (odds ratio: 6.2, 95% confidence interval [CI]: 1.1–41.1) and a high Limberg score (odds ratio: 2.3, 95% CI: 1.4–6.0) were independent predictors of surgery, with an area under the curve of 0.771 (95% CI: 0.602–0.940), accuracy of 83.7%, sensitivity of 96.3%, and specificity of 62.5%. On Cox survival analysis, creeping fat >180° was significantly associated with surgery (hazard ratio, 5.2; 95% CI: 1.2–21.8; $P = 0.03$). In addition, creeping fat was significantly associated with steroid-free clinical remission ($P = 0.015$) and mucosal healing ($P = 0.06$).**

DISCUSSION: **Intestinal ultrasound characteristics can predict outcomes in patients with stricturing CD who undertook biologic therapy.**

KEYWORDS: Crohn's disease; intestinal ultrasound; biologics therapy; treatment response

SUPPLEMENTARY MATERIAL accompanies this paper at http://links.lww.com/CTG/B164; http://links.lww.com/CTG/B165

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INTRODUCTION

Crohn's disease (CD) is a chronic, relapsing, and destructive inflammatory disorder of the gastrointestinal tract. Strictures are a common complication of CD, occurring in approximately 50% of patients, leading to severe intestinal obstruction and significantly impacting quality of life (1). Despite advancements in biologic therapies that have markedly improved CD prognosis, a subset of strictures remains unresponsive to these medications, necessitating surgical intervention. Consequently, identifying strictures that poorly respond to biologic therapy is of significant clinical importance for guiding proper pharmaceutical or surgical treatment strategies, thereby minimizing both economic burden and physiological distress.

Several studies have investigated the prognosis of strictures using a combination clinical factors and morphological findings on magnetic resonance enterography (MRE) (2–7). These studies identified obstructive symptoms, proximal bowel dilatation, and stricture length as key contributors to stricture prognosis, despite

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variations in strictures definitions, follow-up periods, and outcomes measures. Moreover, MRE is limited by prolonged acquisition times and high costs. Intestinal ultrasound (IUS) is a nonradiative, noninvasive, and cost-effective alternative method for detecting inflammatory bowel lesions. Literature has demonstrated that IUS offers comparable accuracy with MRE in assessing disease activity, evaluating complications, and monitoring treatment response in inflammatory bowel disease (8–12). The prognostic value of IUS parameters in predicting the outcomes of strictures in CD has yet to be explored in existing research.

In this study, our objective was to investigate the predictive value of IUS findings for the treatment response of strictures in CD.

METHODS

Study population

This retrospective study was conducted at a tertiary referral hospital in China and was approved by the Institutional Review Board of Peking Union Medical College Hospital. Informed consent was waived by Institutional Review Board.

Consecutively hospitalized patients diagnosed with CD who underwent IUS examinations between September 2016 and March 2021 were eligible for inclusion in this study if they met the following criteria: (i) presence of intestinal obstruction symptoms such as vomiting, abdominal extension, and reduced defecation frequency; (ii) confirmation of bowel strictures by colonoscopy, enteroscopy, or MRE; (iii) IUS examinations were performed contemporarily; (iv) planned initiating treatment with biologics in accordance with European Crohn's and Colitis Organization guidelines, including infliximab, vedolizumab, or adalimumab (13); and (v) regular follow-up for a minimum of 12 months. Patients were excluded if they had concurrent pregnancy, severe systemic diseases, or other bowel disorders such as malignant intestinal tumors, Bechet disease, or intestinal tuberculosis, or if the IUS assessment of the strictures was incomplete.

Baseline demographic information, clinical history, Montreal classification, smoking status, medication usage, surgical history, C-reactive protein levels, albumin levels, Crohn's Disease Activity Index (CDAI), colonoscopy findings, and IUS findings were collected. A treat-to-target strategy was applied, with clinical remission, mucosal healing being regarded as our main treatment targets. Patients underwent follow-up assessments every 3–6 months, including evaluations of clinical symptoms, biochemical markers, and imaging studies. Follow-up endoscopy was performed at least annually or when new symptoms arose.

Outcome measures

The primary end point of this study is bowel surgery for the removal of symptomatic strictures. The secondary end points include steroid-free clinical remission, defined as the absence of obstruction-related symptoms with no use of corticosteroids, and mucosal healing, defined as the absence of ulcers under colonoscopy or enteroscopy. The time interval between baseline IUS and the occurrence of end points was documented. In cases where surgery was not performed, the follow-up period must extend beyond 12 months.

IUS evaluation

The IUS examinations were performed by one of the 3 experienced radiologists (Q.Z., W.L., M.X.), each with over 10 years of expertise in intestinal imaging, utilizing either a Philips iU22 (Philips Healthcare, Bothell, WA) or a SuperSonic Aixplorer (SuperSonic Imaging SA, Aix-en-Provence, France) machine equipped with convex (C5-2) and linear (L9-3) transducers. The examination procedure adhered to the guidelines established by the European Federation of Societies for Ultrasound in Medicine and Biology (14). Patients fasted for at least 8 hours before the IUS examinations. A longitudinal scanning of the colon was performed from the ileocecal region to sigmoid colon, and a mow-like scanning was performed for small intestine assessment. Stricture was identified in accordance with the consensus criteria of the Crohn's disease antifibrotic stricture therapies group, defined as pathological wall thickness (a 25% increase in wall thickness relative to adjacent nonaffected bowel) accompanied by a significant luminal narrowing (at least a 50% reduction in luminal diameter) immediately distal to lumen dilation (diameter $>$ 30 mm) (15). In case of multiple strictures, analysis was focused on the stricture exhibiting the narrowest lumen. On stricture identification, gray-scale transverse and longitudinal images, color Doppler images, and/or videos were captured. Descriptive data including stricture location, maximum bowel wall thickness (BWT), stricture length, bowel wall stratification, Limberg score, and associated complications (e.g., fistulas or abscesses) were documented. Creeping fat, characterized by hyperechoic tissue surrounding the intestine, was also assessed. The wrapping angle of creeping fat on the transverse section of the stricture was measured, with a cutoff value of 180° used to classify strictures into 2 categories (Figure 1).

Retrospectively review of IUS images and videos was performed by a single experienced radiologist specialized in abdominal imaging (L.M.), who was blinded to the clinical, laboratory, and outcomes of the enrolled patients.

Statistics

The sample size for this study was determined based on the following assumptions: the null hypothesis stated that there is no significant difference in ultrasound parameters between the surgery (P_1) and no-surgery groups (P_2), a 2-sided significance level of 0.10, a power of 0.80, and a 30% difference between P_1 and P_2, with the smaller of P_1 and P_2 being 0.10. This calculation resulted in a minimum of 31 participants required for the study.

Statistical analysis was performed using the SPSS Statistics software (v23). Descriptive statistics were presented as number (percent) for categorical variables, mean $\pm$ SD for continuous variables corresponding to a normal distribution (such as C-reactive protein and albumin), and median (interquartile range [IQR]) for continuous variables not corresponding to a normal distribution (including age at enrollment, CD duration, follow-up time, simplified CDAI, Simple Endoscopic Score for CD, BWT, and stricture length).

Differences in clinical and ultrasonographic parameters between surgery and nonsurgery groups were compared using the χ^2 test for categorical variables, the t test for continuous variables corresponding to a normal distribution, and the Mann-Whitney U test for continuous variables not corresponding to a normal distribution. A multivariable binary logistic regression model was constructed for predicting surgery, with all variables having $P <$ 0.1 on univariable analysis included in the multivariable model.

Receiver operating characteristic (ROC) analysis cutoffs were determined using the Youden for optimal accuracy. The results of the multivariate analyses are presented as odds ratios (ORs) with

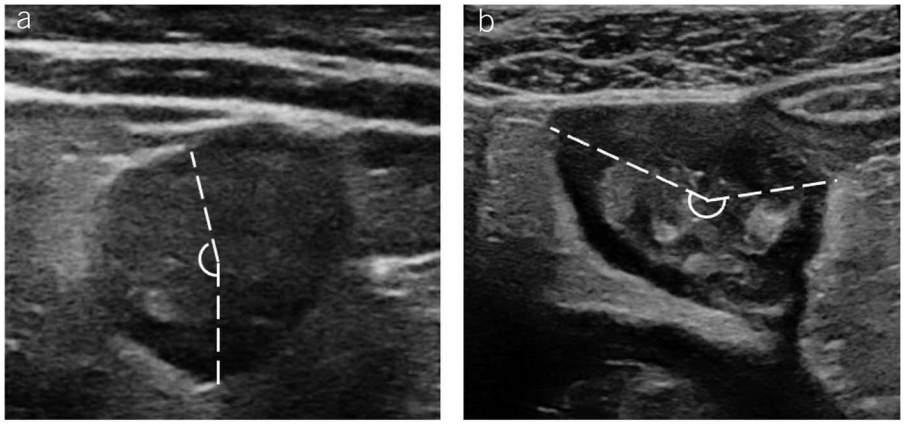

Figure 1. Creeping fat demonstration. On ultrasound, creeping fat is the hyperechoic sheets around the short axis of the intestine, and the wrapping angle is measured as presented. (**a**) creeping fat wrapping <180° and (**b**) creeping fat wrapping >180°.

95% confidence intervals (CIs). Sensitivity and specificity analyses were performed on features that were significant on the multivariable analysis. Cox proportional hazard model was utilized to assess the risks of surgery, and the results were presented as hazard ratio with 95% CI. Kaplan-Meier curves were plotted to assess the temporal rate of events, and the log-rank test was computed for the comparison between surgery and no surgery groups. All reported P values were 2-sided, and $P < 0.05$ was considered statistically significant.

RESULTS

Patient characteristics

During the study period, 49 patients initially met with our inclusion criteria. Six patients were subsequently excluded due to cancer comorbidities (n = 2), intestinal tuberculosis (n = 1), failed identification of the stricture on IUS (n = 2), and loss to follow-up (n = 1). This resulted in a final enrollment of 43 patients.

The demographic descriptions are described in Table 1. Of the enrolled patients, 33 were male patients and 10 were female patients, with a median age of 28 years (IQR 22–35 years). The median disease duration was 55.5 months (IQR 17.8–99 months). According to the Montreal classification, 22 patients (51.2%) were classified as the stricturing type (B2), while 21 patients (48.8%) were classified as the stricturing and penetrating type (B2 + 3). Ten patients (23.2%) had a history of bowel surgery, and 15 patients (34.5%) were smokers. The median simplified CDAI score was 5 (IQR 3–6). Seven patients (16.3%) had a history of biologics usage. At the time of IUS examination, 11 patients (25.6%) were using corticosteroids. Regarding biologic therapy choices, 28 patients (65.1%) chose infliximab, 8 (18.6%) chose vedolizumab, and 7 chose (16.3%) adalimumab. One patient changed from infliximab to vedolizumab due to skin side effects.

IUS characteristics of strictures

Strictures were identified at the ileocecal region in 17 patients (39.5%), colon in 16 patients (37.2%), small intestine in one patient (2.3%), and at the anastomosis point in 9 patients (20.9%). During colonoscopy or enteroscopy, strictures were reached in 37 patients (86.0%), with 7 strictures (18.9%) being passable and 30 strictures (81.1%) nonpassable.

IUS characteristics of the strictures were summarized in Table 2. The median BWT was 8 mm (IQR 7–11 mm), and the median length was 6 cm (IQR 4–7 cm). Stratification of the bowel wall was clear in 7 strictures (16.3%). The strictures exhibited varied Limberg scores (see Table 2). In addition, 18 strictures (41.9%) were accompanied by fistulas, and surrounding enlarged lymph nodes were observed in 23 strictures (53.5%). Creeping fat <180° was observed in 11 strictures (25.6%), while >180° was observed in 32 strictures (74.4%).

Associations between IUS parameters were presented in Supplementary Table 1 (see Supplementary Digital Content 2, http://links.lww.com/CTG/B165). IUS parameters were independent from each other, except for that fistula was associated with creeping fat ($P = 0.05$).

Factors associated with surgery of strictures

The median follow-up time was 17 months (IQR 7–25 months). Twenty-seven patients (62.8%) underwent surgery to remove the stricture, with 4 patients (9.3%) having surgery within 60 days of IUS examinations.

On univariant analysis, BWT, Limberg score, fistula, creeping fat, and disease behavior showed a significant association with surgery (Table 3). In disease behavior, B2 + 3 group underwent surgery more often than B2 (81% [17/21] vs 50% [11/22]). No significant difference in surgery percentages was observed between different biologics ($P = 0.18$).

On logistic multivariant analysis, creeping fat >180° (OR: 6.2, 95% CI: 1.1–41.1) and high Limberg score (OR: 2.3, 95% CI: 1.4–6.0) emerged as independent predictors of surgery (Table 3). ROC analysis revealed an area under the curve (AUC) of 0.771 (95% CI: 0.602–0.940), with an overall accuracy of 83.7%, sensitivity of 96.3%, specificity of 62.5%, positive predictive value of 81.3%, and negative predictive value of 90.1% (Figure 2).

On Cox survival analysis, creeping fat was the sole predictor of surgery (hazard ratio: 5.2; 95% CI: 1.2–21.8; $P = 0.03$). Kaplan-Meier analysis revealed a significant higher cumulative risk of surgery in the creeping fat >180° group than the creeping fat <180° group (log-rank test, $P = 0.01$) (Figure 3).

Factors associated with steroid-free clinical remission and mucosal healing

For patients who did not undergo bowel surgery during the follow-up period, the median follow-up time was 26 months (IQR 22–31 months). Among them, 12 patients (27.9%) achieved

Table 1. Patient characteristics

Characteristics	Patients (n = 43)
Gender, male:female	33:10
Age at enrollment, yr, median (IQR)	28 (22–35)
CD duration, mo, median (IQR)	55.5 (17.8–99)
Age at diagnosis, yr, n (%)	
A1 (≤16)	8 (18.6)
A2 (17-40)	31 (72.1)
A3 (>40)	4 (9.3)
Location, n (%)	
L1 (terminal ileum)	9 (20.9)
L2 (colon)	6 (14.0)
L3 (ileocolon)	28 (65.1)
Behavior, n (%)	
B2 (structuring)	22 (51.2)
B2 + B3 (structuring + penetrating)	21 (48.8)
Perianal disease, n (%)	15 (35.9)
Simplified CDAI, median (IQR)	5 (3–6)
SES-CD, median (IQR)	6 (3–7.3)
CRP, mg/L, mean ± SD	13.5 ± 24.8
Alb, mg/L, mean ± SD	39 ± 9.5
Smoking habits, n (%)	15 (34.5)
Previous bowel surgery, n (%)	10 (23.2)
Previous biologics usage, n (%)	7 (16.3)
Corticosteroids usage at the time of IUS, n (%)	11 (25.6)
Biologics choices, n (%)	
Infliximab	28 (65.1)
Vedolizumab	8 (18.6)
Adalimumab	7 (16.3)
Follow-up time, month, median (IQR)	17 (7–25)
Surgery, n (%)	27 (62.8)
Steroid-free clinical remission, n (%)	12 (27.9)
Mucosal healing, n (%)	8 (18.6)

Alb, albumin; CD, Crohn's disease; CDAI, Crohn's Disease Activity Index; CRP, C-reaction protein; IQR, interquartile range; IUS, intestinal ultrasound; SES-CD, simple endoscopic score for CD.

steroid-free clinical remission, while 8 patients (18.6%) attained mucosal healing as confirmed by colonoscopy or enteroscopy.

On logistic multivariant analysis, creeping fat <180° was the sole predictor of steroid-free clinical remission (OR: 6.8; 95% CI: 1.4–31.6; $P = 0.015$). ROC analysis revealed an AUC of 0.685 (95% CI: 0.493–0.878) (see Supplementary Table 2, Supplementary Digital Content 2, http://links.lww.com/CTG/B165 and Supplementary Figure 1a, Supplementary Digital Content 1, http://links.lww.com/CTG/B164).

Similarly, creeping fat <180° was the only predictor of mucosal healing on logistic multivariant analysis (OR: 4.8; 95% CI: 0.9–24.9; $P = 0.06$). ROC analysis indicated an AUC of 0.664 (95% CI: 0.437–0.891) (see Supplementary Table 3,

Table 2. Baseline intestinal ultrasound characteristics of the strictures

Characteristics	Patients (n = 43)
Location of strictures, n (%)	
Ileocecal region	17 (39.5)
Colon	16 (37.2)
Small intestine	1 (2.3)
Anastomosis	9 (20.9)
BWT, mm, median (IQR)	8 (7–11)
Length of the stricture, cm, median (IQR)	6 (4–7)
Stratified bowel wall, n (%)	7 (16.3)
Limberg score, n (%)	
1	5 (11.6)
2	11 (25.6)
3	9 (20.9)
4	18 (41.9)
Fistula, n (%)	18 (41.9)
Creeping fat, n (%)	
<180°	11 (25.6)
>180°	32 (74.4)
Surrounding lymphadenopathy, n (%)	23 (53.5)

BWT, bowel wall thickness; IQR, interquartile range.

Supplementary Digital Content 2, http://links.lww.com/CTG/B165 and Supplementary Figure 1b, Supplementary Digital Content 1, http://links.lww.com/CTG/B164).

DISCUSSION

In this study, we used IUS to evaluate the characteristics of strictures in CD, and our findings demonstrate that IUS parameters can effectively predict surgery, steroid-free clinical remission, and mucosal healing. Importantly, our result underscores the significant role of creeping fat in both stricture formation and its prognosis.

Several studies have investigated the prognosis of strictures in CD, albeit with considerable heterogeneity in stricture definitions and a focus only on clinical factors and morphological changes (2–7). For instance, Schulberg et al employed one strict criterion defining strictures as an over 80% luminal reduction compared with proximal bowel and identified 3 characteristics on MRE-proximal bowel dilatation, BWT, and stricture length—that could predict surgery with an AUC of 0.76 (4). Similarly, Bouhnik et al (5) assessed 97 symptomatic small bowel strictures and found that shorter stricture length, absence of prestenotic small bowel dilatation, and absence of a stricture-associated fistula on MRE were associated with treatment success with adalimumab. More recently, El Ouali et al (2) demonstrated that obstructive symptoms, duration, and stricture length on MRE were independent and validated predictors of the need for intervention in terminal ileum strictures. In our study, we adopted the Crohn's disease antifibrotic stricture therapies criteria, recommended by expert consensus, to provide a standardized definition of stricture in CD (15). Moreover,

Table 3. Regression analysis of baseline parameters to predict surgery

	Univariate analysis		Multivariant analysis	
	P value	OR	*P* value	OR
Clinical parameters				
Gender (female vs male)	1.00	0.9 (0.2–3.7)		
Age at enrollment, yr	0.98	1.0 (0.8–1.1)		
Age at diagnosis, yr	0.82	14.0 (0.6–313)		
Behavior (B2 vs B2 + B3)	0.08	0.3 (0.1–1.2)	0.17	0.3 (0.6–1.6)
Stricture location[a]	0.23	0.4 (0.1–1.1)		
Disease duration, m	0.65	1.0 (1.0–1.0)		
Smoking habit	0.30	2.0 (0.5–8.1)		
Previous biologics usage	0.25	0.2 (0.0–1.5)		
Previous bowel surgery	1.0	1.2 (0.3–5.8)		
Baseline steroids usage	0.67	1.8 (0.4–8.2)		
Simplified CDAI	0.98	0.8 (0.6–1.1)		
hsCRP, mg/L	0.76	1.0 (0.9–1.0)		
Alb, mg/L	0.40	1.0 (0.9–1.0)		
SES-CD	0.95	1.1 (0.7–1.5)		
Ultrasound parameters				
Length. cm	0.29	0.9 (0.8–1.1)		
BWT, mm	0.07	1.3 (1.0–1.9)	0.17	1.3 (0.9–1.9)
Stratified bowel wall	0.44	2.7 (0.5–13.9)		
Limberg score	0.003	3.0 (1.4–6.4)	0.04	2.3 (1.4–6.0)
Fistula	0.02	5.4 (1.2–23.5)	0.14	3.1 (0.5–18.4)
Creeping fat (>180° vs <180°)	0.001	12.5 (2.2–71.3)	0.06	6.2 (1.1–41.1)
Surrounding lymphadenopathy	0.72	1.3 (0.4–4.3)		
Biologics choices	0.18	1.7 (0.8–3.7)		

Alb, albumin; BWT, bowel wall thickness; CDAI, Crohn's Disease Activity Index; hsCRP, high-sensitivity C-reaction protein; OR, odds ratio; SES-CD, Simple Endoscopic Score for Crohn's Disease.
[a]Stricture location includes ileocecal area, colon, small intestine, anastomosis.

only symptomatic strictures were selected in our study, since our aim was to concentrate on strictures that have a significant impact on clinical course and management. Our inclusion criteria are also adopted in other literature (3,5,6).

In this study, we discovered a significant association between creeping fat and the outcomes of strictures in CD. Creeping fat, characterized by fibrofatty proliferation of mesenteric tissue enveloping inflamed bowel loops, has garnered attention for its potential role in stricture pathogenesis and often linked to underlying inflammatory and fibrotic conditions of the bowel wall (16). Evidence suggests that microbial translocation and

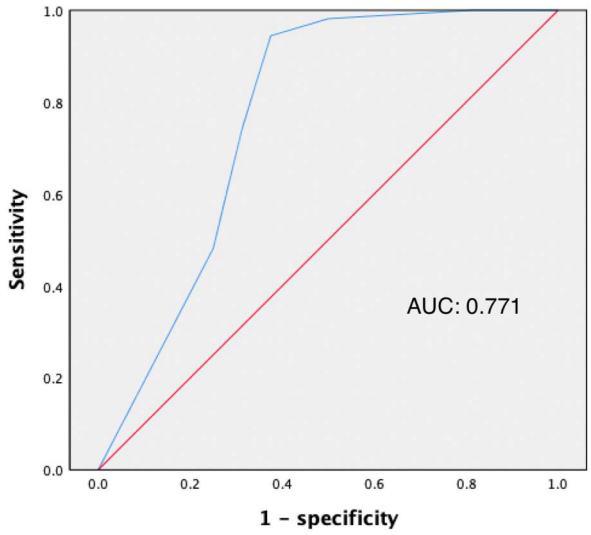

Figure 2. Receiver operating characteristic curve of logistic regression analysis for predicting surgery. AUC, area under the curve.

fibronectin secretion by activated muscularis propria cells may trigger the migration of preadipocytes from mesenteric fat, leading to their differentiation into adipocytes and subsequent stimulation of fibrosis and stricture formation (17,18). Histological examination of intestinal specimens has consistently shown a strong correlation between creeping fat and strictures (19). Therefore, creeping fat is a fundamental characteristic of strictures. Recent studies have reported the visualization of creeping fat by computed tomography enterography and magnetic resonance imaging, with a good correlation with fibrosis in surgical specimens (20,21). For example, Li et al introduced a computed tomography-based mesenteric creeping fat index, exhibiting high interobserver agreement and strong correlation with macroscopic creeping fat and histologic fibrosis scores in surgically resected segments (21). However, the relationship between creeping fat and prognosis remains underexplored. Rimola et al (22) have indicated a correlation between creeping fat and response to tumor necrosis factor-alpha inhibitors in severe inflammatory lesions. Althoff et al (20) found that creeping fat is associated with disabling course, bowel damage, and abdominal surgery. These MR-based studies did not describe the details such as location, number, and wrapping degree of creeping fat. Notably, our study is the first to utilize ultrasound to observe creeping fat and explore its predictive value, which has not been reported in previous studies. Although mesenteric fat is typically challenging to detect under ultrasound in normal circumstances, our findings revealed densely hyperechogenic creeping fat in the vicinity of strictures, contrasting with the hypoechoic bowel wall. These results affirm the significance of creeping fat in predicting stricture outcomes and underscore its potential pivotal role in stricture pathogenesis.

Interestingly, our study found that a higher Limberg score was associated with an increased likelihood of surgery. The Limberg score, which reflects vascularity, has been shown to be closely associated with disease activity (23,24). There are 2 possible explanations for its correlation with surgery: first, stricture with higher Limberg scores often present with more severe symptoms during disease flare-ups, which may necessitate surgical intervention to resolve urgent conditions. Second, if not treated

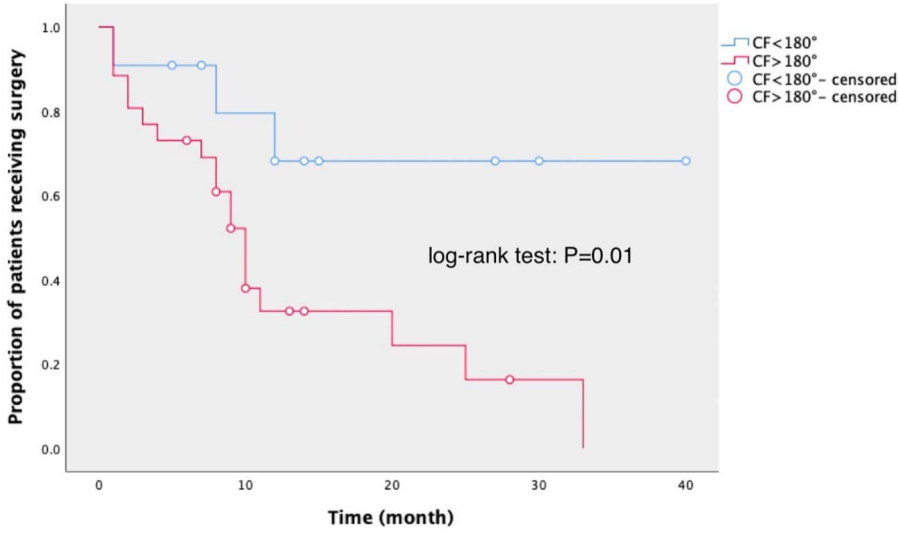

Figure 3. Kaplan-Meier analysis of cumulative risks of surgery between creeping fat (CF) <180° and creeping fat >180° groups.

promptly, bowel walls with higher Limberg scores may develop more prominent fibrosis, ultimately leading to surgery. The underlying mechanisms behind these observations warrant further investigation.

In our cohort, patients were treated with different biologics after stricture formation. The choice of biologic therapy did not significantly impact the risk of surgery, suggesting that biologics may not always be effective in resolving certain strictures, which likely have a high fibrotic component (25–27). Consequently, our findings highlight the importance of IUS in identifying strictures with significant fibrotic content, thereby aiding gastroenterologists in opting for surgical interventions over medication in such cases.

Our study had several limitations. First, certain clinical factors, such as bowel obstruction duration, frequency and other symptoms, were not included in our analysis due to lack of data in this retrospective study. In addition, we did not employ other modalities to validate the assessment of creeping fat. Finally, a preliminary study performed in the single center with a small sample size, which may bring selection bias and affect the multivariate analysis result. Therefore, our findings require further validation using a larger data set in future research.

In conclusion, IUS characteristics, especially creeping fat, can predict the outcome of strictures in patients with CD undergoing biologic therapy. This predictive capability will aid in making timely clinical decisions, allowing for the identification of high-risk patients who may require surgical intervention. Future studies are needed to validate our findings.

CONFLICTS OF INTEREST

Guarantor of the article: Qingli Zhu, MD.

Specific author contributions: All authors have contributed to and approved the final manuscript. L.M., Q.Z. designed the study. W. Li, M.X. and M.Z. performed IUS examinations. Y.H. reviewed the IUS images. L.M. analyzed data. J.Q. helped with ethics approval. L.M. prepared the main manuscript. W. Liu, H.Y., and Q.Z. revised the manuscript.

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Potential competing interests: None to report.

Study Highlights

WHAT IS KNOWN

- ✓ Stricture is a common complication of Crohn's disease.
- ✓ The response to biologics therapy of strictures is hard to predict.

WHAT IS NEW HERE

- ✓ Creeping fat and Limberg score assessed by intestinal ultrasound at baseline can predict surgery of strictures with an area under the curve of 0.77.
- ✓ Ultrasound characteristics can also predict steroid-free clinical remission and mucosal healing of strictures.

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