Prevalence of Malnutrition, Its Risk Factors, and the Use of Nutrition Support in Patients with Inflammatory Bowel Disease

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Background: Malnutrition is prevalent among patients with inflammatory bowel disease (IBD). Nutritional profiles among Asian patients with IBD have seldom been investigated. We assessed the prevalence of and risk factors for malnutrition, use of nutrition support, and sociopsychological status associated with malnutrition among patients with IBD in China.

Methods: Patients with ulcerative colitis and Crohn's disease (CD) recruited from 43 tertiary referral hospitals were screened for malnutrition and nutrient deficiencies in this cross-sectional study. The use of nutrition support was recorded. The sociopsychological status was assessed by subjective questionnaires. Factors associated with malnutrition were analyzed, and multivariate regression was used to determine independent predictors for malnutrition.

Results: We recruited 1013 patients with a median age of 35.0 years, 58.5% of them had CD, and 61.4% of all patients were male. Overall, 49.5% (n = 501) of patients were diagnosed with malnutrition, including 57.0% of patients with CD, 38.8% of patients with ulcerative colitis, and 44.1% of patients with quiescent or mildly active disease. Nutrient deficiencies were prevalent despite the absence of malnutrition. Malnutrition was associated with adverse sociopsychological status, including decreased social support, higher perceived stress, and impaired quality of life. Moderate to severe disease activity and extensive disease were 2 independent risk factors for malnutrition. In total, 41.6% of patients received nutrition support, and patients with risk factors were more likely to receive nutrition support.

Conclusions: Malnutrition was highly prevalent and associated with adverse consequences in Chinese patients with IBD. Malnutrition screening and early initiation of nutrition support are essential components in IBD care.

Lay Summary

We performed mandatory malnutrition screenings in Chinese patients with inflammatory bowel disease across 43 tertiary referral hospitals. Malnutrition was highly prevalent in this population and associated with decreased quality of life. Active and extensive diseases were risk factors for malnutrition.

Key Words: inflammatory bowel disease, malnutrition, nutrition support

Introduction

Malnutrition is prevalent among patients with inflammatory bowel disease (IBD). Malnutrition is often present already at IBD diagnosis and is associated with increased hospitalizations, worse disease prognosis, and higher mortality rates.[1-3] The prevalence of malnutrition is high among patients with IBD, ranging from 10% to 70% across different studies, with most reports describing rates between 10% and 35%.[1,4-7]

Although malnutrition screening has been recommended for patients with IBD, it is not routine practice, which has led to an underestimation of malnutrition and delays in nutrition therapy, especially in Asia, where IBD emerged only in the past decade.[8,9]

Evidence for malnutrition is mainly drawn from Western IBD populations, for which overnutrition, with the obesity epidemic, became an emerging issue in recent years.[10]

Anthropologic characteristics for the population in Asia-Pacific regions differ from those in Latin America and Europe, including lower obesity prevalence and mean body mass index (BMI).[11] To date, the prevalence of malnutrition, characteristics associated with malnutrition, and the use of nutrition support have been seldom investigated among IBD patients in Asia. Malnutrition has adverse sociopsychological impacts on patients with IBD, including anxiety and depression.[12] The association between malnutrition and psychological well-being has rarely been assessed among IBD patients in Asia on a large scale. Therefore, the current study aimed to investigate the prevalence of malnutrition and the use of nutrition support among patients with IBD from tertiary referral hospitals in China. The sociopsychological status among these patients and risk factors for malnutrition were also investigated.

Methods

Study Design and Study Population

This was a cross-sectional, observational study conducted at 43 hospitals across China. Patients were consecutively recruited between July 2017 and December 2017 from participating hospitals regardless of hospitalization status. Inclusion criteria were (1) a confirmed diagnosis of either ulcerative colitis (UC) or Crohn's disease (CD); (2) age between 18 and 75 years; (3) ability to complete all assessments, including subjective questionnaires; and 4) consent to participate in the study. Exclusion criteria were (1) a history of malignancy; (2) pregnancy; (3) diseases with growth retardation, such as Turner's syndrome; and (4) inability to complete the assessment due to intellectual disabilities.

Data Collection

Baseline Characteristics and Malnutrition Assessment

Demographic and clinical features including sex, age, BMI, smoking status, type and classification of IBD, disease duration (time interval between IBD diagnosis and malnutrition screening), disease activity, current and past use of IBD medication, and biochemical and sociopsychological profiles were all recorded using standardized paper-based questionnaires. Malnutrition was evaluated in all patients. Use of nutrition support, including partial enteral nutrition with oral nutrition supplements, exclusive enteral nutrition through nasal gastric tube, and parenteral nutrition, within 2 weeks of the assessment was also recorded.

Patients were diagnosed with malnutrition if they fulfilled the following diagnostic criteria according to the European Society for Parenteral and Enteral Nutrition (ESPEN) consensus statement[13]:

1. BMI lower than 18.5 kg/m², or
2. unintentional weight loss (either more than 10% irrespective of time or 5% within 3 months), together with 1 of the following 2 criteria:
   a. fat-free mass index lower than 15 and 17 kg/m² for female and male participants, respectively, or
   b. reduced BMI (lower than 20 kg/m² for patients younger than 70 years of age or lower than 22 kg/m² for patients over 70 years of age).

A BMI of <18.5 kg/m² was considered underweight, a BMI of ≥25 kg/m² was considered overweight, and a BMI of >40 kg/m² was considered obese. In addition to this malnutrition evaluation, the malnutrition risk using the Nutritional Risk Screening (NRS) 2002 system was also assessed. Patients who scored more than 2 were defined as having an increased risk for malnutrition according to a previous validation study.[14]

Disease Activity and Biochemical Profiles

Disease activity was assessed using the Crohn's Disease Activity Index (CDAI) for CD and the Truelove and Witts score for UC. For patients with CD, a CDAI score ≤220 was classified as quiescent or mildly active disease, a CDAI score between 221 and 450 was classified as moderately active disease, and a CDAI score >450 was classified as severely active disease.[15] For UC patients, the occurrence of diarrhea ≤4 times/d, together with an erythrocyte sedimentation rate ≤30 mm/h, normal hemoglobin, and absence of fever and tachycardia, was classified as mild disease presentation, whereas diarrhea ≥6 times/d, together with erythrocyte sedimentation rate >30 mm/h, hemoglobin decreased by 25% or the patient requiring blood transfusion, and fever and tachycardia, was classified as severe disease presentation. Patients in between these parameters were classified as having moderately active disease.[16] The disease extent was classified according to the Montreal classification; ileocolonic disease in CD and pancolitis in UC were classified as extensive gastrointestinal disease.

Biochemical profiles including serum albumin, hemoglobin, and calcium levels were measured at each participating hospital within 2 weeks of the malnutrition screening. Nutrient deficiencies including hypoalbuminemia, anemia, and hypocalcemia were defined using the reference ranges at each participating hospital.

Sociopsychological Assessment

For sociopsychological assessments, patients were asked to complete 4 questionnaires assessing the quality of life, perceived social support, anxiety and depression, and perceived stress. All questionnaires had been adapted into Chinese versions and have previously been confirmed in Chinese populations as valid and reliable.[17-20] Quality of life was assessed using the Inflammatory Bowel Disease Questionnaire (IBDQ), a 32-item questionnaire well recognized as an assessment tool for quality of life in patients with IBD, which has previously been validated in a Chinese IBD population.[18] Scores range from 32 to 224 with each item rated on a 7-point scale, and a higher score indicates better quality of life. Social support was assessed using the Multidimensional Scale of Perceived Social Support, a 12-item multidimensional scale encompassing social support from friends, family, and significant others. Total scores range from 12 to 84 with each item rated on a 4-point scale, and a lower score indicates lack of social support. The questionnaire was initially adapted into Chinese in 1996 and had been validated among various Chinese populations.[19,21] Anxiety and depression were assessed using the Hospital Anxiety and Depression Scale, a 14-item questionnaire consisting of 2 equally numbered subscales for depression and anxiety, respectively. The questionnaire has previously been validated among Chinese patients with cardiovascular disease.[17] Scores range from 0 to 21 for each subscale, with each item rated on a 4-point scale; a score of ≥8 on each subscale was validated as indicative of possible mood disorder.[22] Stress was assessed using the 14-item perceived stress scale; scores range

from 0 to 56 with each item rated on a 5-point scale, and a cutoff of 25 has been validated in Chinese urban residents as indicative of abnormally high perceived stress.[20,23]

Statistical Analysis

Continuous variables were presented as either the mean ± SD and compared using the independent sample Student's t test or the median (interquartile range) and compared using the Mann-Whitney U test, depending on whether the variable was normally distributed or not. Categorical variables were presented as percentages and compared using the chi-square test. Relative risk was calculated using chi-square analysis. Fisher's exact test was used when the sample size was under 5. In the risk factor analysis, all variables with $P < .1$ in the univariate analysis were stepwise entered into the logistic regression. Results from the multivariate analysis were displayed as odds ratio and 95% confidence intervals. A P value of $<.05$ was considered statistically significant. All analyses were conducted using SPSS software (version 22; IBM Corporation, Armonk, NY, USA).

Ethical Considerations

This study was approved by the Institutional Review Board and ethics committee of the primary participating hospital. All patients signed the consent form prior to participation.

Results

Study Population

A total of 1013 patients were recruited including 805 (79.5%) hospitalized patients and 96 (9.5%) ambulatory patients; the hospitalization status of 112 patients was not reported. Overall, 593 (58.5%) patients were diagnosed with CD (Table 1), and 622 (61.4%) patients were male, comprising the dominant group, especially among patients with CD. The median age was 35.0 (interquartile range, 27.0-48.0) years for all patients, and patients with CD were significantly younger than those with UC. The mean BMI was 19.43 ± 3.11 kg/m² for all patients, and patients with CD had lower BMI than patients with UC. In total, 437 (43.1%) patients were underweight, and only 42 (4.1%) patients were overweight, with 3 patients (1 with CD and 2 with UC) being obese. Patients with ileocolonic, nonstricturing, nonpenetrating CD and those with extensive UC dominated. The majority of patients with CD had disease remission or mild disease activity, whereas the majority of patients with UC had moderate to severe disease. The use of steroids was also more common in patients with UC than in those with CD.

Prevalence of Malnutrition

A total of 501 patients were diagnosed with malnutrition, yielding a prevalence of 49.5%. BMI was 17.11 ± 1.73 kg/m² for malnourished patients, and 437 (87.2%) patients with malnutrition were underweight. There was 1 out of 42 overweight patients that was also diagnosed with malnutrition. A total of 193 patients were diagnosed with malnutrition based on low BMI alone. Among patients with malnutrition, the proportion of underweight patients with CD was significantly higher than patients with UC (91.7% vs 77.9%, $P < .01$). The proportion of underweight patients did not differ between different sexes, by hospitalization status, or among different age categories. The prevalence of malnutrition was higher in CD than UC, higher in female patients than in male patients,

and decreased with advanced age (Table 2). Among the 632 patients with quiescent or mildly active disease, 44.1% (n = 279 of 632) were malnourished, which increased to 50.7% (n = 247 of 487) in CD and decreased to 22.1% (n = 32 of 145) in UC. For patients with moderate to severe disease, the prevalence of malnutrition increased significantly, with 58.2% (n = 222 of 381; $P < .05$) in patients overall, 85.5% (n = 91 of 106; $P < .05$) in patients with CD, and 47.6% (n = 131 of 275; $P < .05$) in patients with UC.

Biochemical and Sociopsychological Profiles

Biochemical and sociopsychological profiles were recorded and compared between patients with and without malnutrition (Figure 1A, B). Although anemia, hypoalbuminemia, and hypocalcemia were more frequent in malnourished patients (52%, 45.5%, and 51.1%, respectively), these nutrient deficiencies also existed among well-nourished patients, with 29.8%, 22.7%, and 42.5% of patients being affected by anemia, hypoalbuminemia, and hypocalcemia, respectively. A total of 741 (73.1%) patients returned valid questionnaires on sociopsychological assessments, including 375 (73.2%) well-nourished patients and 366 (73.1%) malnourished patients. The average IBDQ score among all patients was 150.0 ± 42.2, and malnutrition was associated with a further decrease (well-nourished vs malnourished patients: 157.0 ± 45.9 vs 142.0 ± 36.5; $P < .01$). Malnutrition was also associated with decreased social support scores (well-nourished vs malnourished patients: 63.8 ± 10.2 vs 61.6 ± 11.3; $P < .01$), and patients with malnutrition were more likely to report high perceived stress (well-nourished vs malnourished patients: 71.5% vs 83.1%; $P < .01$). The 2 groups were similar regarding rates of anxiety and depression, which were all higher than 95%, regardless of nutritional status.

Use of Nutrition Support

A total of 421 (41.6%) patients received nutrition support. Malnourished patients were more likely to receive nutrition support than well-nourished patients (well-nourished vs malnourished patients: 38.1%, n = 164 of 512 vs 51.3%, n = 257 of 501; $P < .01$). Among the 164 well-nourished patients who received nutrition support, 53 patients were assessed as having malnutrition risk according to their NRS-2002 scores. Among the remaining 111 patients without malnutrition risk, the majority (n = 73 of 111, 65.8%) had moderate to severe disease. In total, 305 patients reported the length of nutrition support, with the majority (n = 267 of 305, 87.5%) lasting less than a month, and only 14 (4.6%) patients received relatively long-term support for more than 2 months. Overall, 364 (86.5%) patients reported the routes of nutrition support, including 169 (40.1%) patients who received enteral nutrition, 136 (32.3%) who received parenteral nutrition, and 59 (14.0%) patients who received a combination of enteral and parenteral nutrition.

Patients who received nutrition support were comparable in terms of age, sex, and disease duration to those without nutrition support, but they had lower BMI (18.73 ± 3.10 kg/m² vs 20.10 ± 2.99 kg/m²; $P < .01$) and IBDQ (145.5 ± 47.8 vs 152.4 ± 37.3; $P = .024$) scores. Patients with CD were more likely to receive nutrition support than patients with UC (65.6% vs 53.5%; $P < .01$). Among patients with CD, the proportion of patients receiving nutrition support was independent of the presence of strictures or fistulas. In addition, 23.5% of patients with strictures or fistulas received

Table 1. Baseline characteristics of all patients who underwent nutritional status assessment

Variable	CD (n = 593)	UC (n = 420)	P Value
Female	196 (33.1)	195 (46.4)	<.01
Age, y[2]	30.0 (24.0-41.0)	45.5 (31.8-54.3)	<.01
BMI, kg/m^2	18.73 ± 2.90	20.41 ± 3.12	<.01
<18.5 kg/m^2	310 (52.3)	127 (30.2)	<.01
18.5-25 kg/m^2	265 (44.7)	269 (64.1)	<.01
≥25 kg/m^2	18 (3.0)	24 (5.7)	<.01
Current smokers	48 (8.1)	45 (10.7)	<.01
Disease duration, y[22]	3.0 (1.0-7.0)	2.9 (1.0-6.6)	<.01
Disease location of CD	—	—	—
Distal ileum/limited cecal	184 (31.1)	—	—
Colonic	104 (17.5)	—	—
Ileocolonic	305 (51.4)	—	—
Upper GI[a]	40 (8.5)	—	—
Disease behavior of CD	—	—	—
Nonstricturing, nonpenetrating	287 (48.4)	—	—
Stricturing	190 (32.0)	—	—
Penetrating	116 (19.6)	—	—
Perianal disease	206 (34.7)	—	—
Disease extent of UC	—	—	—
Proctitis	—	54 (12.9)	—
Left-sided colitis	—	134 (31.9)	—
Extensive colitis	—	232 (55.2)	—
Disease activity	—	—	<.01
Quiescent/mild	487 (82.2)	145 (34.5)	—
Moderate	82 (13.8)	146 (34.8)	—
Severe	24 (4.0)	129 (30.7)	—
Current medication	—	—	—
Aminosalicylic acid	135 (22.8)	346 (82.4)	<.01
Steroids	76 (12.8)	125 (29.8)	<.01
Immunosuppressants	186 (31.4)	27 (6.4)	<.01
Biologics	208 (35.1)	24 (5.7)	<.01
Previous medication	—	—	—
Aminosalicylic acid	296 (49.9)	353 (84.0)	<.01
Steroids	152 (25.6)	181 (43.1)	<.01
Immunosuppressants	189 (31.9)	35 (8.3)	<.01
Biologics	173 (29.2)	21 (5.0)	<.01

Values are n (%), median (interquartile range), or mean ± SD.
Abbreviations: BMI, body mass index; CD, Crohn's disease; GI, gastrointestinal tract; UC, ulcerative colitis.
[a]A total of 120 patients were not assessed regarding upper GI involvement.

parenteral nutrition, which was not significantly higher than this frequency in patients with pure inflammatory disease behaviors (19.1%). In total, 46.3% (n = 184 of 381) of patients with moderate to severe disease received nutrition support, which was higher than this percentage in patients with quiescent or mildly active disease (37.5%, n = 237 of 632). Patients with a more extensive disease were also more likely to receive nutrition support (n = 240 of 537, 44.7% vs n = 176 of 476, 37.0%; P = .013) (Supplementary Table 1).

Risk Factors Associated With Malnutrition
Demographic- and IBD-related features were compared between patients with and without malnutrition. In univariate analyses, malnutrition among patients with CD was associated with younger age, shorter disease duration, presence of either strictures or fistulas, ileocolonic disease, moderate to severe disease, and current use of steroids or immunosuppressants. In addition, CD patients with malnutrition were less likely to receive biologics as treatment. Neither the presence of upper gastrointestinal diseases nor the presence of prior CD-related bowel surgeries was associated with malnutrition among patients with CD. Malnutrition among patients with UC was associated with younger age, female sex, extensive disease, and moderate to severe disease. UC patients with malnutrition were more likely to be treated with steroids (Supplementary Tables 2 and 3). The results of the multivariate logistic regression suggested that ileocolonic disease, moderate to severe disease, presence of strictures or fistulas, current use of

Table 2. Prevalence of malnutrition stratified by IBD subtype, age, and sex

Patient Group	Malnutrition	RR (95% CI)	P Value
Overall	501 (49.5)	—	—
IBD subtype	—	—	—
UC	163 (38.8)	1	—
CD	338 (57.0)	2.090 (1.620-2.696)	<.01
Age	—	—	—
18 y ≤ age < 45 y	384 (55.8)	1	—
45 y ≤ age < 65 y	102 (38.1)	0.486 (0.364-0.649)	<.01
65 y ≤ age ≤ 75 y	15 (26.3)	0.283 (0.154-0.520)	<.01
Sex	—	—	—
Male	286 (46.0)	1	—
Female	215 (55.0)	1.435 (1.113-1.850)	<.01

Values are n (%), unless otherwise indicated.
Abbreviations: CD, Crohn's disease; CI, confidence interval; IBD, inflammatory bowel disease; RR, relative risk; UC, ulcerative colitis.

steroids, and shorter disease duration were independent risk factors for malnutrition among patients with CD. For patients with UC, extensive disease, active flare, and female sex were independent risk factors for malnutrition, and the risk for malnutrition decreased with increasing age (Table 3).

Discussion

In this cross-sectional, multicenter study, we report a malnutrition prevalence of 49.5% among patients with IBD in China. Nutrient deficiencies were present regardless of nutritional status. Malnutrition was associated with impaired quality of life and adverse sociopsychological status among patients with IBD. Moderate to severe disease and extensive disease were independent risk factors for malnutrition, and patients with these risk factors were more likely to receive nutrition support.

Almost half of the patients were diagnosed with malnutrition, which is higher than previously reported rates between 10% and 35%.[1,5-7] There are several contributory factors to higher malnutrition prevalence, including a study population comprising mainly hospitalized patients and the use of a mandatory screening process. In hospital-based studies with more proactive screening strategies, malnutrition prevalence rates were reported to be as high as 69.7%, whereas a prevalence of <8% was reported in a population-based study in which universal screening for malnutrition was not performed.[1,4-7] In addition, differences in obesity prevalence among patients in Asia-Pacific regions, Latin America, and Europe might also be a contributing factor.[11] The Western population is now facing an obesity epidemic, and overnutrition is an emerging issue that affects patients with IBD.[10] In our study, <6% of patients were overweight, which is a much lower frequency than in previous reports in which obesity was recorded in up to 31% of patients.[10,24] Because the ESPEN criteria were not specifically developed for the Asian population, a unifying BMI for diagnosis of malnutrition across different populations may lead to inaccuracy in the estimation of malnutrition. However, the average BMI of the IBD population in the current study was already lower than the non-IBD population in China back in 2009, which was 23.0 kg/m² in average. In
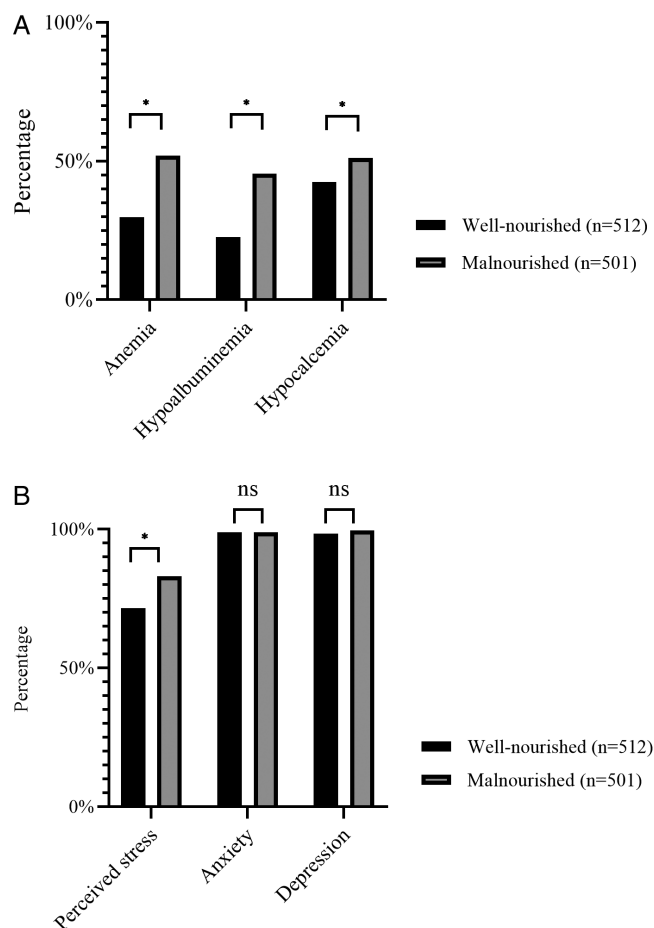
Figure 1. A and B, Biochemical and sociopsychological profiles among patients with different nutritional statuses. *$P < .05$; ns, not significant.

addition, the average BMI of Chinese population has been increasing over the past decades according to a population-based investigation.[25] Therefore, results from the current investigation did reflect a generally poorer nutritional status among patients with IBD in China. Use of ESPEN criteria minimized interobserver bias across different study sites, as it adopted a simple and objective evaluation of malnutrition. Given the sample size of our study, and a universal screening strategy being adopted across all participating hospitals, the influence of selection bias on the results were minimal.

In the current study, patients with CD had higher malnutrition prevalence than those with UC; moderate to severe disease and extensive gastrointestinal disease were the 2 major risk factors for malnutrition regardless of IBD subtypes. It was previously speculated that patients with CD were at higher risk of malnutrition compared with those with UC due to more extensive gastrointestinal involvement.[8] The presence of fistulas further increases the risk of malnutrition in patients with CD, which was also observed in the current study.[1] Active inflammation impairs intestinal absorption and increases protein requirements. In addition, gastrointestinal symptoms lead to altered dietary behaviors, all of which are contributory to malnutrition.[1,26,27] Nutrition support is recommended during disease flares and when poor nutritional status cannot be improved via the oral route.[8] Likewise, we discovered that patients with CD were more likely to receive nutrition support, possibly as a result

Table 3. Multivariate analysis of risk factors associated with malnutrition among patients with CD or UC

IBD Type	Variable	OR	95% CI	P Value
CD	Ileocolonic disease (yes vs no)	2.350	1.414-3.649	<.01
	Moderate to severe disease (yes vs no)	5.571	2.736-11.346	<.01
	Presence of strictures (yes vs no)	3.357	2.007-5.616	<.01
	Presence of fistulas (yes vs no)	2.090	1.136-3.845	.018
	Disease duration, every increase in 1 y	0.925	0.882-0.971	<.01
	Current use of glucocorticoids (yes vs no)	2.407	1.247-4.646	<.01
UC	Age, every increase in 1 y	0.958	0.942-0.975	<.01
	Female (yes vs no)	2.851	1.765-4.605	<.01
	Pancolitis (yes vs no)	2.025	1.237-3.317	<.01
	Moderate to severe disease (yes vs no)	2.760	1.604-4.750	<.01

Abbreviations: CD, Crohn's disease; CI, confidence interval; IBD, inflammatory bowel disease; OR, odds ratio; UC, ulcerative colitis.

of higher malnutrition prevalence and more active disease. Nutrition therapy such as exclusive enteral nutrition is also considered an important treatment for active CD, especially among pediatric patients, and it also effectively decreases the severity and reoccurrence of fistulas.[28,29] Accordingly, we suggest that nutrition therapy is of great value in the care of IBD patients, especially of patients with CD.

Although increased age is considered a risk factor for malnutrition due to decreased lean body mass, malnutrition was associated with younger age in the current study.[14] In addition, we found a significant association between malnutrition and shorter disease duration, which was similar to findings of previous studies that showed a decrease in malnutrition prevalence with longer disease duration.[10,30] It should be noted that disease duration in the current study was defined as the time since an IBD diagnosis had been confirmed. A delayed diagnosis might adversely affect the nutritional status due to a prolonged disease course with no timely treatment, but this issue was not addressed in this study. In the current investigation, the observation that malnutrition was associated with shorter disease duration might suggest less controlled disease courses among newly diagnosed patients compared with patients with a longer disease course who already received treatment and achieved remission.[10] Given the fact that malnutrition can affect younger patients with newly diagnosed diseases, we speculate that more active diseases among younger patients might be a contributing factor to such an observation.[3] Besides, patients with CD had higher malnutrition prevalence and were generally younger than patients with UC in the current study; therefore, the IBD subtype may also serve as a link between younger age and malnutrition. Nevertheless, the number of older patients was relatively small compared with younger patients, which limited the power of our analysis. In addition, dietary behaviors such as food restriction might also be a contributing factor, as demonstrated by a previous study suggesting that younger patients were more likely to restrict food intake compared with older patients during disease flares.[5] Further investigations on how active food restriction affects nutritional status may uncover the etiology behind such observations in the current study population.

We found that malnutrition was associated with the female sex. Previous studies seem to have inconsistent findings regarding sex differences in the risk for malnutrition. Valentini et al[31] showed possible trends toward higher malnutrition

prevalence among female patients with UC, and Gee et al[32] also discovered that protein undernutrition was more prevalent among female patients. However, Nguyen et al[1] showed that female sex may be a protective factor against malnutrition. Owing to these inconsistencies across studies, the ESPEN guideline does not recommend a sex-specific strategy for nutritional care, and our results did not identify any sex differences that impact the use of nutrition support.

Malnutrition is associated with multiple adverse events including increased frequency of emergency department attendance and nonelective surgeries, resulting in a higher likelihood of postoperative complications such as infection and prolonged wound healing. Malnutrition also increases the length of hospital stay, results in higher medical expenditure, and increases mortality.[1,33-35] Malnourished patients also experience frequent episodes of depression, anxiety, and lower quality of life.[12,36] The association between sociopsychological status and malnutrition has been scarcely explored among patients with IBD in Asia. In our study, malnutrition was associated with higher perceived stress and decreased social support; in addition, we discovered a surprisingly high prevalence of depression and anxiety among patients with IBD, similar to a previous report.[37] There are multiple interactive relationships among disease flares, malnutrition, and mental health. Decreased appetite directly leads to malnutrition in patients with mood disorders, and for patients with IBD, anxiety is associated with an increase in disabling symptoms such as abdominal pain, which also interferes with food intake.[38] In addition, active flares and altered dietary behaviors contribute to malnutrition, causing metabolite dysregulation and possibly resulting in a higher risk for mood disorders.[12] The high prevalence of mood disorders and lack of social support in association with malnutrition among patients with IBD suggests that psychological interventions and the establishment of support systems are necessary, especially for patients with malnutrition.

Using mandatory screening protocol, we discovered that prevalence of malnutrition was high. Though several risk factors for malnutrition were identified in our study, patients without these risk factors, such as patients during quiescent or mildly active disease, still faced a malnutrition prevalence of 44.1%. This was consistent with previous studies, in which 26% to 30% of patients in disease remission were diagnosed with malnutrition.[6,27,31] Therefore, screening for malnutrition is essential, including screening among patients without identifiable

risk factors for malnutrition. In fact, the ESPEN guideline recommends malnutrition screening for all patients with IBD at diagnosis and thereafter.[8] However, around 33% of gastroenterologists do not routinely screen patients for malnutrition, and up to two-thirds of patients report unmet dietetic needs during clinic visits, which results in delayed nutrition support.[4,9,10] Consistent with previous observations, we found that nutrient deficiencies including anemia and hypoalbuminemia were prevalent, suggesting that a negative malnutrition screening result does not exclude the need for nutrition support.[3,31] Nutrition support has been shown to induce mucosal healing and enhance postoperative recovery, which are beneficial even when achieved on a short-term basis.[29,39,40] Therefore, universal screening is essential, and the use of nutrition support should be based on multiple perspectives including nutrient profiles, patients' needs, and potential therapeutic benefits.

This study has several limitations. First, though the majority of patients who received nutrition support were diagnosed with malnutrition, having disease flares, or at increased risk for developing malnutrition, we did not investigate the exact reasons why nutrition support was initiated and the detailed route of nutritional support the patient received. For example, it is not known if the patients were on exclusive enteral nutrition for treatment purpose or were merely receiving oral nutritional products as dietary supplements. Also, we did not investigate if these patients actually met the ESPEN criteria to initiate exclusive enteral nutrition or parenteral nutrition (eg, unable to achieve nutrition requirements by the oral route). However, because duration for nutrition support was short for most of the patients, it was more likely that patients received nutrition product as dietary supplements rather than as part of therapy for CD. In addition, it should be noted that the NRS-2002 system has not been validated among an ambulatory population. Though outpatients consisted a small population in the current study, malnutrition risk screening results among outpatients should be interpreted with caution. Second, dietary behaviors such as food restrictions and dietary consultations provided to patients were not investigated in this study. These are important aspects of nutrition support in patients with IBD, which require more robust investigations in the future. Third, the number of elderly patients in the current study was too small to be representative of this age group, and patients over 75 years of age were excluded. Therefore, the association between aging and reduced malnutrition risk is likely biased and should be interpreted with caution. Future studies investigating the nutritional status in older patients with IBD will provide more pertinent insights into the aging population. Last, owing to the nature of this cross-sectional multicenter study with a large sample size, the consistency of the sociopsychological assessments as well as anthropometry were not fully guaranteed. Detailed instructions for all questionnaires were provided, and all investigators were trained regarding the proper use of the questionnaires prior to the investigations to ensure minimal bias across study sites regarding use of questionnaires.

Conclusions

This was the first study to report the prevalence of and risk factors for malnutrition, as well as the use of nutrition support in Chinese patients with IBD. We showed that malnutrition was highly prevalent. In addition, nutrient deficiencies and adverse sociopsychological status were present even among patients without malnutrition. We also found that malnutrition was associated with the worsening of these adverse events. This study highlights the importance of malnutrition screening and early initiation of nutrition support in patients with IBD.

Supplementary Data

Supplementary data is available at *Inflammatory Bowel Diseases* online.

Author Contributions

All authors have contributed to the following: (1) conception and design of the study, data acquisition, analysis, and interpretation; (2) drafting and revising of the article; and (3) final approval of the version to be submitted. J.Liu, X.G.: study design, data analysis and interpretation, writing up the first draft, draft revision. C.O., D.W., X.Z., J.Liang: study design, patient recruitment, data acquisition and interpretation, draft revision. W.Z., Q.C: study design, patient recruitment, data interpretation, writing up the first draft, draft revision.

Conflicts of Interest

The authors declare that they have no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

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