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Original Article

Symptoms Burden and Health-related Quality of Life in Chinese Patients with Primary Biliary Cholangitis

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Abstract

Background and Aims: Primary biliary cholangitis (PBC) is a chronic liver disease that negatively affects the health-related quality of life (HRQoL) of patients. Furthermore, the HRQoL of Chinese patients has been neglected for a long time. The present study aimed to assess the HRQoL of Chinese patients with PBC and explore the clinical variables correlating to the improvement of itch and fatigue. ***Methods:*** This was an observational, cross-sectional study. The PBC-40 and itch numerical rating scales were used to evaluate the symptoms and HRQoL of patients. ***Results:*** A total of 383 patients were recruited, and 86.4% were female, with a median age of 55 years (range: 49–63 years). We found that females had significantly higher scores than males in symptoms (p=0.033) and cognitive domains (p=0.021), and the fatigue domain was higher in elderly patients (p=0.007). Meanwhile, patients whose body mass index was <18.5 had the highest scores in the symptoms (p=0.009), fatigue (p=0.010), and cognitive (p=0.019) domains. Age at participation (odds ratio [OR]=1.068, p=0.015) and albumin level at 12 months after ursodeoxycholic acid treatment (OR=208.807, p=0.025) were independent factors that affected the improvement of the itch and fatigue domains, respectively. ***Conclusions:*** The HRQoL of Chinese patients with PBC was significantly impaired depending on sex, age, and body mass index. Age and albumin level were significantly associated with the improvement of itch and fatigue, respectively. Therefore, treatment and support aimed at these two factors can be provided to improve the HRQoL of patients.

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Keywords: Primary biliary cholangitis; PBC-40; Health-related quality of life; Pruritus.

Abbreviations: ALP, alkaline phosphatase; ALT, alanine aminotransferase; AST, aspartic transaminase; BMI, body mass index; HRQoL, health-related quality of life; NRS, numerical rating scale; OCA, obeticholic acid; PBC, primary biliary cholangitis; UDCA, ursodeoxycholic acid.

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Introduction

Primary biliary cholangitis (PBC) is a chronic autoimmune cholestatic liver disease that predominantly affects women in their 50s and 60s. It is progressive and can lead to end-stage liver disease in the absence of effective treatment. In recent years, the incidence and prevalence of PBC have been constantly increasing, along with increased awareness and evolved diagnostic activity of this disease.[1] Although the etiology of PBC remains elusive, evidence has shown that interaction of immunogenetic and environmental factors may contribute to the development of PBC.[2] The goal of life-long therapy is to prevent progressive liver disease while improving subsequent symptoms, such as itches and fatigue, which could greatly reduce the health-related quality of life (HRQoL) of patients.[3] Ursodeoxycholic acid (UDCA) and obeticholic acid (OCA) are the only two drugs that were approved by the Food and Drug Administration as treatment for PBC, but the latter is still not available in China. However, despite extensive studies validating the efficacy of UDCA for the improvement of liver biochemical variables, whether UDCA is beneficial for PBC-associated symptoms is controversial.[4]

Due to its distinct serologic and liver biochemical signature, PBC can be diagnosed at an early stage. Disease-associated symptoms and psychological stress caused by early diagnosis may have a huge impact on the HRQoL of patients with PBC. In order to accurately understand the symptoms of patients with PBC, the PBC-40, comprising 40 questions assessing six distinct domains, was developed to evaluate the HRQoL of patients with PBC.[5] It has been validated in many cohorts from different countries and districts[6–14] and broadly used in clinical trials.[15–17]

Studies of HRQoL among patients with PBC from Europe, especially the UK, have found that age and sex are two important factors in the symptoms of patients with PBC.[11] A poor correlation between response to UDCA and mitigation of symptoms has been reported.[8] On the other hand, a recent study of Japanese patients with PBC drew different conclusions from European reports,[13] indicating that ethnic, geographical, and cultural factors may contribute to the symptoms of these patients. Therefore, the experience gained from other districts may not be extrapolated to patients with PBC in China. Wong *et al*.[18] performed a study in 2008 focusing on Chinese patients with PBC in a relatively small cohort and used the 36-item Short-Form Health Survey (i.e. SF-36) instead of PBC-40, which is more specific to PBC. They found that Chinese patients with PBC had significant impairment of HRQoL, but the results needed to be

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further verified.

To further investigate the therapeutic effect of UDCA on the symptoms and HRQoL of patients with PBC, we performed an observational cross-sectional study using the PBC-40 and itch numerical rating scale (NRS). In this study, we described the clinical status of patients and assessed their HRQoL and symptoms in a Chinese cohort. We also explored the clinical variables related to the improvement of itch and fatigue in patients treated with UDCA.

Methods

Study design and patients

This was an observational cross-sectional study of patients with PBC recruited from Xijing Hospital (tertiary hospital) from January 2007 to June 2020 following the STROBE guidelines.[19] All patients were diagnosed using standard diagnostic criteria[20,21] (defined as the presence of two of the following three: presence of anti-mitochondrial antibody or other PBC-specific autoantibodies, including sp100 or gp210; cholestatic liver biochemical evidence; and compatible or diagnostic liver histology). Patients with the following criteria were excluded: presence of other liver diseases, including autoimmune hepatitis and chronic hepatitis B; a history of liver transplantation; and comorbidities that had severe symptoms, such as rheumatoid arthritis with severe pain and psoriasis. All patients in this study were out-patients who underwent regular check-ups. They were administered a standardized, self-completed questionnaire, and detailed clinical information was collected at Xijing Hospital. The questionnaires were distributed in either a face-to-face manner or using a social software (WeChat). Only one staff member was responsible for collecting the answers to the questionnaire and matching clinical information, and the personal information of patients in the subsequent analysis data was anonymized. Written informed consent was obtained from all patients for inclusion in the study. The procedures followed in this study were approved by the Ethics Committee of Xijing Hospital in correspondence with the ethical guidelines of the 1975 Declaration of Helsinki.

HRQoL assessment tools

We used the PBC-40 in the Chinese language to assess the HRQoL of patients with PBC. The PBC-40 is a profile measure that covers six PBC-specific quality of life domains (symptoms, itch, fatigue, cognitive, social, and emotional).[5] Each domain included 7, 3, 11, 6, 10, and 3 items, respectively. Scores for each item ranged from 1 to 5 points (defined as 1=never, 5=always), except for symptoms, itch, and social domain. These three domains had items with the option "does not apply," which was 0 points. Thus, the possible range of scores in each domain was 1–35, 0–15, 11–55, 6–30, 7–50, and 3–15, respectively. In this study, we defined the severity of each domain into four categories as shown in Supplementary Table 1, which was validated by Newton *et al*.,[22] and designed a question to evaluate patients' self-assessment of their integral health condition, which allowed patients to estimate their health condition 4 weeks prior to choosing from excellent, very good, good, normal, and bad.

As pruritus and fatigue are the most characteristic symptoms of PBC, patients were asked to rate their itch and fatigue domains at two different time points: the last 4 weeks and before they took UDCA. A pruritus NRS was also used. Patients were asked to rate their level of pruritus on a scale of 0 to 10, where 0 was no itch and 10 was unbearable itch, in the last 4 weeks.

Definition of improvement of itch and fatigue

To investigate which clinical variables of patients with PBC were correlated with the improvement of itch and fatigue, we defined "improvement" as the severity categories of itch or fatigue domain becoming better and "non-improvement" as the severity categories remained the same or became worse. A flowchart of the study is shown in Figure 1.

Statistical analyses

Normally distributed quantitative variables are presented as mean±standard deviation, and non-normally distributed data are presented as median (interquartile range). Descriptive statistics are presented as frequencies (*n* [%]). Correlation coefficients between the PBC-40 scores and integral health assessments were determined using the Spearman rank correlation test. Differences between continuous data of two groups were compared using the Mann-Whitney *U* test and those among three or more groups using the Kruskal-Wallis *H* test. Differences in the itch and fatigue scores before and after treatment were compared using the Wilcoxon matched-pairs signed rank test. To determine the significance of clinical variables in the predictive improvement of itch and fatigue, multivariate analysis was applied using a logistic regression model, with the matching of the itch and fatigue scores before UDCA treatment. All analysis were performed using GraphPad Prism 8.0 (GraphPad Software, San Diego, CA, USA) and SPSS 22 (IBM Corp., Armonk, NY, USA); a p-value of <0.05 was considered statistically significant.

Results

Study participants

A total of 383 patients diagnosed with PBC were recruited, and their clinical information is shown in Table 1. Most patients (86.4%) were female, with a median age of 55 years (range: 49–63 years). The median follow-up period after diagnosis was 4 years (range: 2–7 years). Treatment with vitamin AD, vitamin E, and calcium tablets was reported in 356 (93.0%), 367 (95.8%), and 359 (93.7%) patients, respectively. Only two (0.5%) patients did not receive UDCA as treatment. Histological findings at diagnosis were obtained from 219 (57.2%) patients, and Ludwig staging (I/II/III/IV) were 41/109/34/35, respectively.

PBC-40 scores

The median scores of each domain were as follows: 2.1 (1.7–2.6) for symptoms, 1.0 (1.0–2.0) for itch, 2.2 (1.5–2.8) for fatigue, 2.2 (1.5–3.0) for cognitive, 2.4 (1.9–3.0) for social, and 2.7 (2.0–3.3) for emotional (Fig. 2A). The distribution of severity for each domain is shown in Figure 2B. The most frequently seen status was mild (74.7%) for symptoms, none (52.2%) for itch, and mild for fatigue (60.8%), cognitive (49.9%), social (52.5%), and emotional domains (49.3%). Significant correlations were observed between the domains of PBC-40 (Fig. 2C). The fatigue domain showed the strongest correlation with the other five domains, whereas the itch domain showed the weakest correlation. The strongest

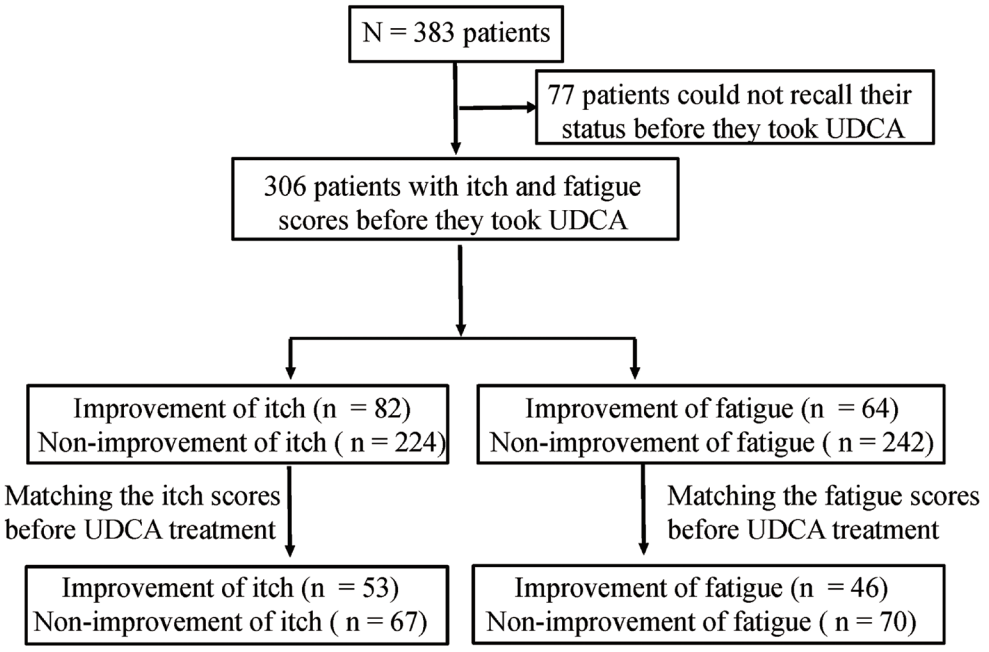

Fig. 1. Flowchart of the whole study.

correlations within the PBC-40 were observed between the fatigue and cognitive domains (r=0.619, p<0.001) and the social and emotional domains (r=0.624, p<0.001). At the same time, the emotional domain was the most related domain (r=0.542, p<0.001) with self-assessment of the overall health status of patients with PBC, while the itch domain was the least related (r=0.199, p<0.001).

We then explored the distribution of scores for each domain according to different demographic manifestations (Table 2). Elderly patients tended to have higher fatigue scores, especially those aged >70 years (p=0.007). Patients whose body mass index (BMI) was <18.5 were more likely to be affected by symptoms (p=0.009), fatigue (p=0.010), and cognitive (p=0.019) domains. The scores for symptoms (p=0.033) and cognition domains (p=0.021) were significantly higher in women than in men.

Besides, the PBC-40 scores were also analyzed according to the response of UDCA. As defined in Paris I criteria[23] and Paris II criteria,[24] no impact of UDCA response on the patients' HRQoL was found (Supplementary Table 2).

Table 1. Clinal and laboratory characteristics of all participating patients

Characteristic	Value from among the study cohort, *n*=383
Female sex,%	331 (86.4)
Age, years	55 (49–63)
Follow-up period, years	4 (2–7)
HGB, g/L	130 (113–139)
PLT, *10E9/L	158 (94–215)
ALT, IU/L	26 (18–44)
AST, IU/L	34 (26–49)
ALB, g/L	42.9 (39.1–45.6)
TBIL, μmol/L	14.3 (10.6–20.8)
ALP, IU/L	116 (89–170)
GGT, IU/L	71 (33–165)
Histology stages	
I	41
II	109
III	34
IV	35

ALB, albumin; GGT, gamma-glutamyl transpeptidase; HGB, hemoglobin; PLT, platelet; TBIL, total bilirubin.

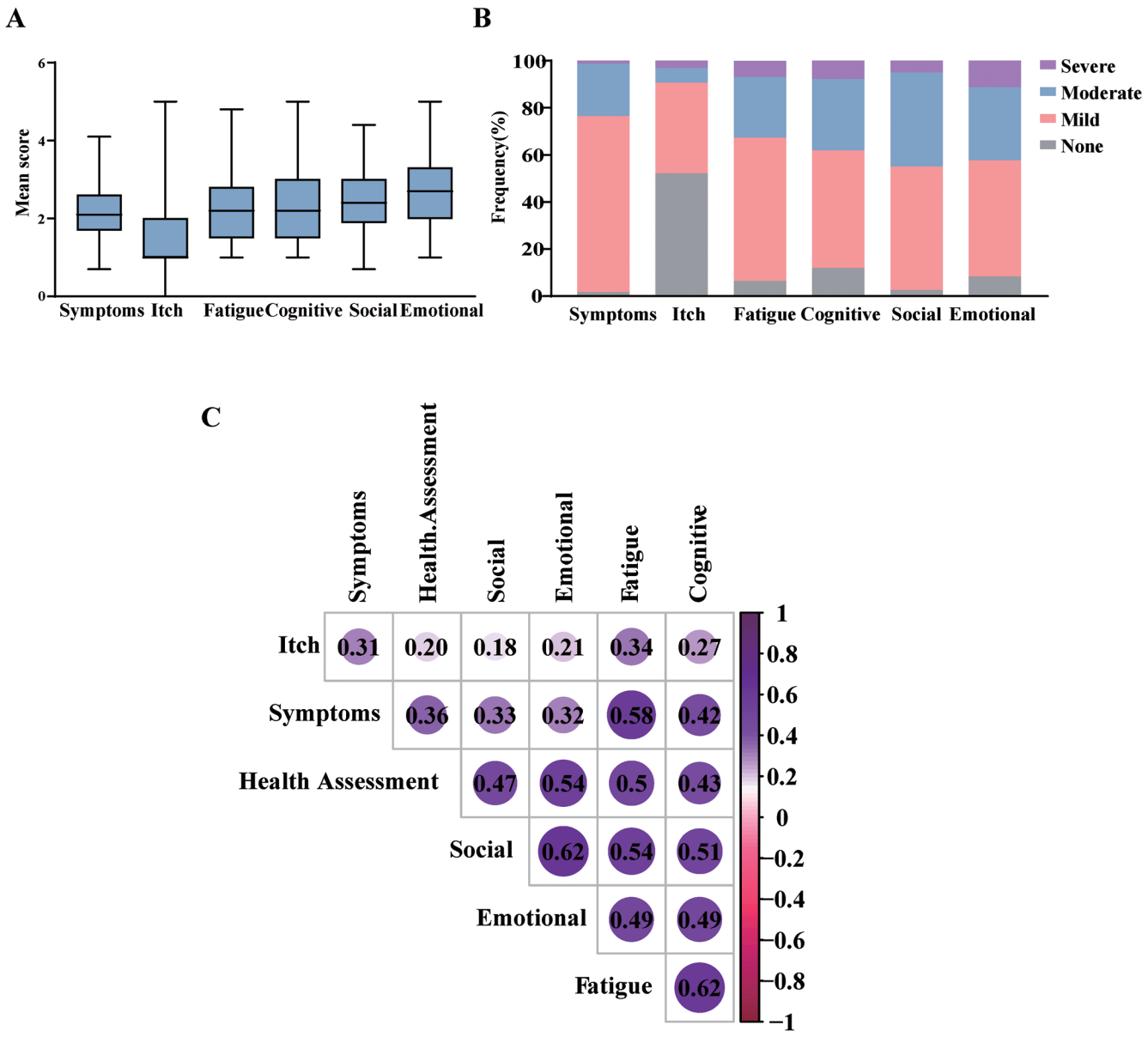

Fig. 2. PBC-40 scores of the entire cohort. Average scores (A) and distribution (B) of each PBC-40 domain among our patients (n=383). (C) The association of each domain in PBC-40 with the self-assessment of overall health status of PBC patients. The radium of circles and the darkness of coloration indicate correlation coefficients.

Pruritus NRS

The median pruritus NRS score was 1 (0–3). Patients with different sex, age, and BMI showed no significant difference in pruritus (Supplementary Table 3).

Association of variables with PBC-40 fatigue and itch domain

In our study, 306 patients recalled their fatigue and itch status before they underwent UDCA. After the standard treatment provided by our institution, significant improvement was found in both the itch (p<0.001; Fig. 3A) and fatigue (p=0.019; Fig. 3B) domains.

Subsequently, a logistic regression analysis was performed to identify clinical variables that can predict the improvement of itch and fatigue. As the itch and fatigue scores of patients before UDCA treatment between the "improvement" and "non-improvement" groups were not even; patients in the "improvement" group had significantly higher scores than the "non-improvement" group. To avoid this bias, we matched the itch and fatigue scores before treatment, separately. After the matching, 120 patients and 116 patients were selected to create two new cohorts, to separately investigate the clinical variables related to the improvement of itch and fatigue. Univariable regression analysis identified older age at participation, longer follow-up duration, lower aspartic transaminase (AST), and alanine aminotransferase (ALT) levels at 12 months after UDCA treatment significantly correlated with improvement of itch

Table 2. Scores of PBC-40 domains among patients with different demographic characteristics

Parameter	Symptoms	Itch	Fatigue	Cognitive	Social	Emotional
Sex						
Male	14.0 (11.0–17.0)	4.0 (3.0–5.0)	22.5 (15.3–27.8)	11.5 (7.0–16.0)	24.5 (18.0–29.0)	7.0 (5.0–9.0)
Female	15.0 (13.0–18.0)	3.0 (3.0–6.0)	24.0 (18.0–31.0)	13.0 (9.0–18.0)	24.0 (19.0–31.0)	8.0 (6.0–10.0)
Z value	−2.130	−0.404	−1.934	−2.304	−0.535	−1.922
p-value	0.033	0.686	0.053	0.021	0.592	0.055
Age in years						
<40	13.0 (10.0–17.0)	3.0 (3.0–6.0)	19.0 (15.0–29.0)	11.0 (8.0–14.0)	24.0 (18.0–30.0)	9.0 (6.0–10.0)
40–50	15.5 (12.8–19.0)	3.0 (3.0–7.0)	24.0 (18.8–32.0)	13.0 (10.0–18.0)	26.0 (20.0–32.0)	8.0 (6.0–10.0)
50–60	15.0 (13.0–18.0)	3.0 (3.0–6.0)	24.0 (17.0–29.0)	13.0 (8.0–18.0)	25.0 (18.8–29.3)	7.5 (6.0–9.3)
60–70	15.0 (12.0–18.0)	3.0 (3.0–5.0)	23.0 (15.8–31.0)	12.5 (8.0–17.0)	23.0 (18.0–30.3)	8.0 (5.0–9.0)
≥70	17.5 (11.8–21.0)	4.0 (3.0–8.0)	32.0 (21.5–38.0)	16.0 (10.5–20.0)	23.5 (18.0–30.3)	8.0 (5.8–10.0)
H value	8.391	4.384	14.213	6.104	3.938	5.030
p-value	0.078	0.356	0.007	0.191	0.414	0.284
BMI in kg/m^2						
<18.5	17.0 (14.0–20.0)	3.0 (3.0–6.5)	28.0 (20.5–36.0)	15.0 (11.0–18.0)	28.0 (21.0–34.0)	8.0 (7.5–10.0)
18.5–24	15.0 (13.0–18.0)	3.0 (3.0–6.0)	24.0 (18.0–31.8)	13.0 (9.0–18.0)	24.0 (19.0–30.0)	8.0 (6.0–10.0)
24–28	14.0 (11.0–17.0)	4.0 (3.0–6.0)	22.0 (14.5–27.0)	12.0 (7.5–16.0)	23.0 (18.0–30.0)	7.0 (5.5–9.0)
≥28	14.0 (12.5–21.5)	5.0 (3.5–8.0)	27.0 (18.5–34.5)	11.0 (7.0–15.0)	27.0 (19.0–29.0)	7.0 (4.5–10.0)
H value	11.640	2.042	11.306	9.896	4.155	4.359
p-value	0.009	0.564	0.010	0.019	0.245	0.225

domain, and multivariable analysis identified older age as an independently contributing factor (Table 3). The higher albumin levels at 12 months after UDCA treatment also independently contributed to the improvement of fatigue domain (Table 4).

Since a large amount of data was missing during the matching, we investigated the correlation between the itch and fatigue scores with the clinical variables of patients before UDCA treatment. The alkaline phosphatase (ALP) level was found to be significantly correlated with the itch score (r=0.194, *p*=0.001; Fig. 4A), and albumin levels were significantly correlated with the fatigue scores (r=−0.152, *p*=0.012; Fig. 4B).

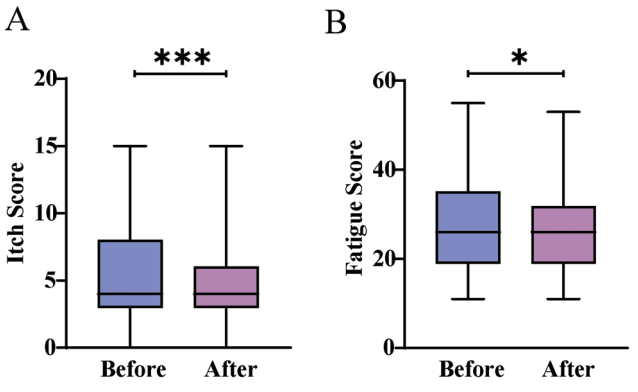

Fig. 3. Changes of itch and fatigue scores after UDCA treatment. Scores of itch domain (A, ***p<0.001, Wilcoxon matched-pairs signed rank test) and fatigue domain (B, *p<0.05, Wilcoxon matched-pairs signed rank test) significantly decreased after standardized treatment.

Discussion

PBC is a chronic and progressive disease of the liver. With UDCA being used worldwide, patients' liver biochemistries and prognosis have improved significantly. However, there is still no effective intervention for the main symptoms of PBC, itching, and fatigue, especially the latter. The absence of valid intervention for symptoms and mental stress derived from the chronic nature of PBC could negatively impact the HRQoL of patients. Studies from patients with PBC in Europe,[6–12] Canada,[14] and Japan,[13] whereby different results have indicated that ethnicity, geography, and culture, might have an influence on PBC symptoms. Therefore, it is of great importance to explore the HRQoL of Chinese patients. In the present study, we enrolled 383 Chinese patients with PBC and measured their HRQoL and pruritus. We found that there was a heavy burden of impaired HRQoL in Chinese patients with PBC, which was significantly affected by sex, age, and BMI, while the response to UDCA seemed to have little impact on the symptoms of patients. Meanwhile, age and albumin level at 12 months after UDCA treatment were found to be independent factors that affected itch and fatigue, respectively.

Our cohort was consistent with the PBC characteristics of female predominance in their 50s. Almost every patient was on UDCA 13–15 mg/kg/day as treatment, and most of them were given oral supplementation of fat-soluble vitamins, as recommended by the guidelines.[20,21] Interestingly, itch, which is the most characteristic symptom of PBC, had the lowest score of the PBC-40 scores, and more than half of the patients were in the "none" category, while emotional score was the highest. This distribution was the same as in reports published in other districts,[13,22] indicating that this might be a universal phenomenon of PBC. Similarly, the

Table 3. Univariate and multivariate analysis of the association between clinical and laboratory variables with improvement of PBC-40 itch domain score

	Univariate analysis		Multivariate analysis		
	Odds ratio	***p*-value**	**Odds ratio**	**95% CI**	***p*-value**
Age at diagnosis, years	1.028	0.135			
Age at participation, years	1.047	0.015	1.068	1.013–1.126	0.015
Treatment duration, years	0.207	0.003			
Female sex, %	2.311	0.136			
PLT at diagnosis, *LLN	0.642	0.096			
ALB at diagnosis, *LLN	1.772	0.685			
ALP at diagnosis, *ULN	1.036	0.709			
GGT at diagnosis, *ULN	1.019	0.455			
ALT at diagnosis, *ULN	0.907	0.225			
AST at diagnosis, *ULN	0.889	0.173			
TBIL at diagnosis, *ULN	0.778	0.038			
PLT 12 months postdiagnosis, *LLN	0.557	0.047			
ALB 12 months postdiagnosis, *LLN	0.074	0.131			
ALP 12 months postdiagnosis, *ULN	0.991	0.972			
GGT 12 months postdiagnosis, *ULN	0.992	0.907			
ALT 12 months postdiagnosis, *ULN	0.663	0.045			
AST 12 months postdiagnosis, *ULN	0.507	0.037			
TBIL 12 months postdiagnosis, *ULN	0.946	0.729			

LLN, lower limit of normal; TBIL, total bilirubin; ULN, upper limit of normal.

Table 4. Univariate and multivariate analysis of the association between clinical and laboratory variables with improvement of PBC-40 fatigue domain score

	Univariate analysis		Multivariate analysis		
	Odds ratio	***p*-value**	**Odds ratio**	**95% CI**	***p*-value**
Age at diagnosis, years	0.975	0.234			
Treatment duration, years	0.990	0.855			
Female sex, %	1.301	0.680			
PLT at diagnosis, *LLN	1.793	0.038			
ALB at diagnosis, *LLN	1.845	0.666			
ALP at diagnosis, *ULN	0.921	0.474			
GGT at diagnosis, *ULN	0.978	0.391			
ALT at diagnosis, *ULN	1.139	0.178			
AST at diagnosis, *ULN	1.007	0.926			
TBIL at diagnosis, *ULN	0.929	0.356			
PLT 12 months postdiagnosis, *LLN	1.834	0.052			
ALB 12 months postdiagnosis, *LLN	310.961	0.009	208.807	1.971–22,122.388	0.025
ALP 12 months postdiagnosis, *ULN	0.952	0.828			
GGT 12 months postdiagnosis, *ULN	0.990	0.885			
ALT 12 months postdiagnosis, *ULN	0.992	0.968			
AST 12 months postdiagnosis, *ULN	0.922	0.747			
TBIL 12 months postdiagnosis, *ULN	0.732	0.308			

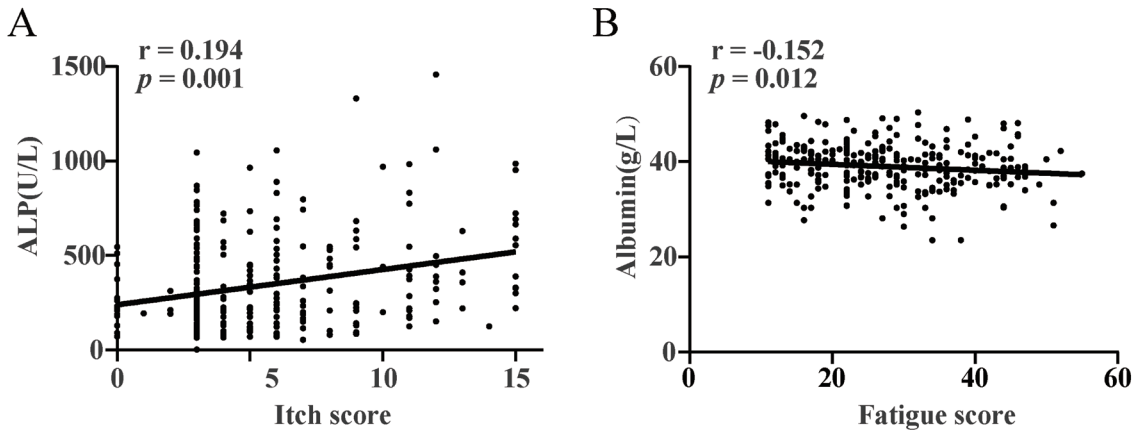

Fig. 4. Correlations between the individual PBC-40 domains and standard laboratory variables. (A) Association between the ALP level and score of itch domain at diagnosis (r=0.194, *p*=0.001, Spearman rank correlation test). (B) Association between the albumin level and score of fatigue domain at diagnosis (r=−0.152, *p*=0.012, Spearman rank correlation test).

emotional domain was found to have the strongest correlation with the self-assessment of the health condition of the patients, indicating that patients might need more support to relieve the anxiety induced by PBC. However, the average scores of each domain of PBC-40 were lower than the original PBC-40 report from the British cohort[5] but close to the scores from a Japanese cohort,[13] verifying that ethnic and cultural backgrounds might influence the symptoms and HRQoL of patients. In our study, the HRQoL of patients with adequate response and inadequate response to UDCA showed no significant difference, which indicated that there was little correlation between UDCA response and patient symptoms. Due to the unavailability of OCA in China, none of our patients received it as a treatment. Therefore, we cannot assess the effect of OCA on HRQoL in patients with PBC. However, it is important to explore the HRQoL of patients with PBC who receive OCA as it could cause pruritus exacerbation in 1–10% of patients.[17,25,26] Further studies are needed to explore the effect of OCA on the HRQoL of PBC patients and compare the differences between UDCA and OCA.

In addition, males seem to be less affected by the symptoms than females, further confirming that sex is strongly related to individual symptoms.[11,13] Meanwhile, age was observed as a determinant of fatigue score. We found that elderly patients were more likely to experience fatigue. Our study is the first to identify that BMI is correlated with HRQoL in patients with PBC. Patients with a smaller BMI were easily affected by symptoms, fatigue, and cognition. The impact of age on fatigue is quite in line with common sense, but it is unclear why women and patients who weighed less had more severe autonomic symptoms. Previous studies have found that obesity is associated with cognitive deficits.[27] It is thought to be associated with a negative impact on the brain via mechanisms of low-grade systemic inflammation, elevated lipids, and/or insulin resistance attributed to obesity. We speculated that patients with lower BMI might be contrary to those who are overweight, and their cognitive function is more sensitive. It was reported that women had significantly higher empathic concern and affective distress than men,[28] which might be attributed to the larger frontal brain structures of women, including areas that are critical for generating empathic responses such as the middle and frontal gyri, as well as the anterior cingulate gyrus, compared to men.[29] The sex hormone has been found to participate in many physiological regulations in humans,[30,31] providing a possible explanation of why women and men have different autonomic symptoms.

Pruritus is the most frequently mentioned symptom of PBC. Although the itch domain of PBC-40 contains thorough evaluations of pruritus, the NRS is easier to use and to explain. We found that the pruritus intensity in our patients was more moderate than that in the UK[7] and showed no correlation with clinical demographics. However, pruritus is a quite polarized symptom, and patients with severe itching still need more effective intervention.

Finally, we explored the clinical variables associated with the improvement in itch and fatigue. To identify the factors most related to the symptoms of patients, we introduced a very strict standard for "improvement", which is the severity categories of itch or fatigue getting better after treatment with UDCA. In this way, older age at participation was associated with improvement of itch after adjustment for itch score at participation. On the other hand, higher albumin levels were associated with improvement in fatigue after adjustment for the fatigue score at participation. To avoid the bias caused by patient elimination in the matching, the correlation between the itch and fatigue scores with clinical variables before UDCA treatment of all patients was explored, and the same results were shown. It has been reported that younger age at diagnosis is an independent factor of non-response to UDCA and symptoms such as fatigue and itch.[11] Our results further confirmed that elderly patients tended to improve on itch. Like previous studies that revealed fatigue as being related to albumin levels,[13,32] results of our study indicated that albumin might be involved in the generation of fatigue. However, further studies are still needed to elucidate the underlying mechanism. At the same time, albumin supplementation might be a solution to relieve fatigue in patients, and albumin levels might be used to predict the HRQoL of patients.

There were some limitations to the present study. The relatively small sample size from a single institution limited the accuracy and universality of our findings. All the results here were self-reported by patients; therefore, they may be prone to potential recall bias. The lack of controls made it difficult to confirm that the symptoms reported by patients were PBC-specific. Finally, more scales, such as SF-36, should be used to provide a more comprehensive assessment of the HRQoL of patients with PBC.

In the present study, the HRQoL of Chinese patients with PBC was first examined and described. We verified the impaired HRQoL of patients with PBC in China, and this impairment was related to sex, age, and BMI, but not to the response to UDCA treatment. Furthermore, we found that age and albumin level were independent factors for the

improvement of itch and fatigue separately; thus, specific treatment and support targeting these two factors may be provided to improve the HRQoL of patients. With the widespread use of UDCA as treatment for PBC, the life expectancy of patients has been greatly prolonged. However, our findings demonstrated that more studies focusing on the symptoms and HRQoL of patients should be conducted, and the mechanism behind the symptoms related to PBC needs to be explored.

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Conflict of interest

The authors have no conflict of interests related to this publication.

Author contributions

Study conception and design (YH, YS), acquisition of data (GJ), analysis and interpretation of data (YL, ST), drafting of the manuscript (YL), critical revision of the manuscript for important intellectual content (YH, YS), and technical, or material support (ZH, CG).

Data sharing statement

All data are available upon request.

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