

# The Mediating Effect of Resilience on the Relationship Between Symptom Burden and Anxiety/Depression Among Chinese Patients with Primary Liver Cancer After Liver Resection

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**Purpose:** Primary liver cancer (PLC) is a common cancer of the digestive system. Patients with PLC often experience a heavy symptom burden and along with a significant levels of anxiety and depression after liver resection. High levels of symptom burden can lead to increased anxiety and depression, whereas high levels of resilience can alleviate these conditions. Therefore, we aimed to explore the relationships among symptom burden, resilience, and anxiety/depression in Chinese patients with PLC after liver resection and to determine whether resilience mediates the relationship between symptom burden and anxiety/depression.

**Patients and Methods:** A total of 223 postoperative PLC patients were recruited from two public hospitals in Anhui Province, China. All participants completed the MD Anderson Symptom Inventory (MDASI), Hospital Anxiety and Depression Scale (HADS), and Connor-Davidson Resilience Scale (CD-RISC). The mediating effect of resilience was estimated using the bootstrap method via IBM SPSS AMOS 26.0.

**Results:** The mean HADS score was  $12.37 \pm 6.03$  points in postoperative PLC patients. Among these patients, 78 (34.98%) had anxiety, and 64 (28.70%) had depression, as indicated by a subscale score  $\geq 8$ . Pearson correlation analysis revealed that anxiety/depression was positively associated with symptom burden ( $p < 0.05$ ) and negatively associated with resilience ( $p < 0.05$ ). Furthermore, resilience partially mediated the relationship between symptom burden and anxiety/depression ( $\beta = 0.04$ ; 95% confidence interval: 0.01–0.08).

**Conclusion:** The levels of anxiety and depression in postoperative PLC patients should be decreased. Resilience partially mediated the relationship between symptom burden and anxiety/depression, but the indirect effect was much weaker than the direct effect of symptom burden on anxiety/depression. Consequently, rather than focusing primarily on resilience interventions, joint symptom-psychological interventions focusing on symptoms should be considered for patients with PLC after hepatectomy to reduce the levels of anxiety/depression.

**Keywords:** anxiety, depression, liver cancer, resilience, surgery, symptom burden

## Introduction

Primary liver cancer (PLC) is a common cancer of the digestive system, encompassing three distinct pathological subtypes: hepatocellular carcinoma (HCC), intrahepatic cholangiocarcinoma (ICC), and mixed hepatocellular carcinoma-cholangiocarcinoma (cHCC-CCA).<sup>1</sup> According to the latest data from the World Health Organization (WHO), liver cancer is the sixth most common type of cancer worldwide and the third leading cause of cancer-related death, with 905,700 new cases and 830,200 deaths in 2020. Chinese patients account for more than half of liver cancer patients worldwide.<sup>2</sup> In 2020, liver cancer ranked fourth in new cases (410,000) among all malignancies and ranked second in deaths (391,100), well above the global total.<sup>2,3</sup> The main curative treatment for liver cancer is liver resection, which

entails the direct removal of the diseased tissue and has a significant therapeutic effect on patients who meet surgical conditions. This is the first choice of treatment for liver cancer.<sup>4</sup>

However, surgical resection involves large blood vessels and vital organs, and most patients experience psychological problems after experiencing surgical trauma.<sup>5</sup> Liver resection requires removal of part of the liver tissue, and after the operation, patients are at risk of postoperative complications such as fluid retention in the body cavity, hemorrhage, bile leakage, and hepatic failure, which can lead to psychological problems such as anxiety, fear, and depression.<sup>6,7</sup> Patients who undergo liver resection also experience moderate to severe postoperative pain, postoperative anesthesia, various intubation and other stressors, which can easily lead to anxiety and depression.<sup>8,9</sup>

Anxiety and depression are two of the most common psychological problems in cancer patients. The presence of anxiety and depression can significantly reduce patients' compliance with treatment,<sup>10</sup> leading to more difficulty with symptom management during treatment and prolonged hospitalization,<sup>11</sup> thereby seriously affecting their prognosis and reducing overall survival.<sup>5,12,13</sup> Studies have shown that approximately 42.00% of PLC patients have varying degrees of anxiety after liver resection, and 48.70% of patients have varying degrees of depression.<sup>14</sup> Living with anxiety and depression may seriously affect the quality of life of PLC patients.<sup>15</sup>

In addition to psychological problems such as anxiety and depression, PLC patients also experience a heavy burden of physical symptoms after undergoing surgery. As liver resection is a significant invasive surgery that involves vital organs and large blood vessels, it can elicit multiple postoperative symptoms in patients. These symptoms can include abdominal incision pain due to pulling,<sup>16</sup> metabolic dysfunction or nutrient absorption disorders, which often manifest as feelings of fatigue and lethargy in patients.<sup>17,18</sup> The traction of adjacent organs during surgery, as well as the negative effects of anesthetic drugs and prolonged postoperative gastrointestinal dysfunction, may result in gastrointestinal symptoms, including nausea and bloating.<sup>19</sup> A systematic review aimed to create an item bank of patient-reported symptoms for patients with hepatobiliary or pancreatic malignancies found that 40 self-reported symptoms were present following hepatectomy.<sup>20</sup> A survey on the symptom burden of 160 Chinese patients with PLC who underwent liver resection showed that 100% had fatigue, pain, decreased appetite, dry mouth, and bloating.<sup>21</sup> Of the 19 symptoms evaluated on the MD Anderson Symptom Inventory (MDASI) and the Symptom Module specific to Primary Liver Cancer (TSM-PLC) scales, 11 exhibited a prevalence exceeding 50%, with 5 demonstrating a severity score of  $\geq 4$ .<sup>21</sup> Thus, PLC patients experience a high number of symptoms, high severity, and a heavy symptom burden.

In liver cancer patients, several studies have confirmed the relationships of symptoms with anxiety and depression, reporting that a heavy symptom burden leads to high levels of anxiety and depression.<sup>22,23</sup> However, the mechanisms by which symptoms affect anxiety and depression are unclear. Resilience is a dynamic process that maintains normal psychological and physiological functions<sup>24</sup> and dynamically and appropriately self-regulates after experiencing severe stress or trauma to avoid or reduce psychological problems. The American Psychological Association defines resilience as a "process" ability that enables individuals to adapt well to adversity, trauma, tragedy, threat, and even severe stressors.<sup>25</sup> Previous studies have shown that a high level of resilience can help patients face the disease optimistically, actively cooperate with treatment and rehabilitation, and alleviate anxiety and depression levels.<sup>26</sup> Resilience may reduce anxiety and depression by fostering some unique characteristics (self-examination, responsibility, tolerance, the ability to adapt to different environmental requirements, and a sound perspective on reality).<sup>27,28</sup> Previous studies have confirmed the mediating role of resilience in the relationships of some psychological symptoms with anxiety and depression, including stress, loneliness, and burnout.<sup>29–32</sup> However, physical symptoms such as pain and bloating are the primary symptoms experienced by patients with PLC after liver resection, alongside psychological symptoms. Further research is needed to investigate the relationships of symptom burdens with anxiety and depression in PLC patients.

Therefore, we conducted this survey to identify and explore the relationships among symptom burden, resilience, and anxiety/depression in postoperative PLC patients. There were two main hypotheses. First, we hypothesized that a lighter symptom burden and higher resilience in postoperative PLC patients are associated with lower anxiety/depression. Second, we hypothesized that the relationship between symptom burden and anxiety/depression is mediated by resilience.

## Materials and Methods

### Methods

#### Study Design

This cross-sectional study was conducted from September 2021 to July 2022 in two general hospitals in Anhui Province, China. This study was approved by the Ethics Committee of Anhui Medical University (No. 84220046). All participants provided informed consent. The research was conducted in accordance with the ethical guidelines outlined in the Declaration of Helsinki.

#### Participants

A total of 223 patients with PLC who underwent surgery were selected by convenience sampling methods. The inclusion criteria for hospitalized patients were as follows: (1) age  $\geq 18$  years, diagnosed with PLC encompassing HCC, ICC and cHCC-CCA by pathological examination; (2) underwent liver resection for the first time; and (3) provided informed consent to participate in the study. The exclusion criteria were as follows: (1) diagnosed with other serious physical diseases; (2) participating in other clinical trials or related treatments that may impact this study; (3) unconsciousness or communication impairment and (4) family protection of the patient's condition.

#### Procedures

This survey was conducted after PLC patients were hospitalized for surgery. Before the investigation, the researchers contacted the hospital and obtained consent. Then, the researchers distributed questionnaires to PLC patients with stable vital signs, and clear consciousness within 3 days after the operation. Three trained researchers who were trained were responsible for administering the questionnaire survey. The training content included the research purpose and significance, content description of questionnaires and scales, and data collection methods and precautions. Before the formal investigation, each researcher explained the purpose and significance of the study to the patients using standardized instructions. After obtaining informed consent, the researchers distributed questionnaires face-to-face, and the patients completed the questionnaires according to their current conditions. The researchers collected the questionnaires on the spot and checked their completion to ensure the quality of the questionnaires. A total of 223 questionnaires were distributed, all of which were returned, thus yielding a survey recovery rate of 100%. Clinical data were reviewed and supplemented based on the information documented in the hospital information system (HIS).

### Materials

#### The Demographic Information Questionnaire

The self-designed demographic and disease-related questionnaire collected sociodemographic information such as age, sex, education level, and residence, as well as disease characteristics including time since diagnosis, history of hepatitis, and history of cirrhosis.

#### MD Anderson Symptom Inventory (MDASI)

The symptom burden of individuals was assessed with the Chinese version of the MDASI, which was originally developed by Cleeland et al<sup>33</sup> and translated by Wang et al<sup>34</sup> (Cronbach's  $\alpha$  values of 0.86 and 0.84, respectively). The inventory contains 19 items divided into 2 sections. The MDASI-Part I evaluates the severity of 13 common cancer symptoms, such as pain, nausea, and fatigue, in the past 24 hours. Each item is scored on a scale from 0 (no symptoms) to 10 (the most severe imaginable). The MDASI-Part II evaluates the distressing effects of the 13 abovementioned symptoms on six aspects of daily life, including general activities, emotions, work, relationships with others, walking, and joy of life. Each item is scored on a scale from 0 (no trouble) to 10 (completely bothered). Cronbach's  $\alpha$  coefficient for this scale was 0.81 in this study.

#### Hospital Anxiety and Depression Scale (HADS)

The levels of anxiety and depression were measured using the HADS, which was originally developed by Zigmond et al<sup>35</sup> (Cronbach's  $\alpha = 0.88$ ). The scale contains 14 items divided into 2 subscales, namely anxiety ( $n = 7$ ) and depression ( $n = 7$ ). Each item is scored on a 4-point scale from 0 to 3, with higher scores indicating higher anxiety and depression. A subscale score  $\geq 8$  indicates anxiety or depression. Cronbach's  $\alpha$  coefficient for this scale was 0.86 in this study.

## Connor-Davidson Resilience Scale (CD-RISC)

Resilience was measured using the CD-RISC, which was originally developed by Conner et al<sup>36</sup> and then translated and revised by Yu et al<sup>37</sup> (Cronbach's  $\alpha = 0.90$ ). The scale contains 25 items divided into 3 subdimensions, including tenacity ( $n = 13$ ), strength ( $n = 8$ ) and optimism ( $n = 4$ ). Each item is rated on a 4-point scale ranging from 1 (completely inconsistent) to 4 (completely consistent), with higher scores indicating better resilience. Cronbach's  $\alpha$  coefficient for this scale was 0.89 in this study.

## Statistical Analysis

Data were processed with Excel, and data analysis was completed with SPSS 26.0. Quantitative variables that exhibited a normal distribution are presented as the mean  $\pm$  standard deviation; otherwise variables are presented as the median and interquartile range (IQR). Qualitative data are described with the frequency and percentage. Means were compared between two groups using a *t* test if the data were independent, normally distributed, and exhibited homogeneity of variance; means were compared between more than two groups using one-way analysis of variance (ANOVA) if the data were independent, normally distributed, and exhibited homogeneity of variance. If the data did not meet these assumptions, a rank sum test was performed. In addition, Pearson correlation analysis was performed to explore the relationships among symptom burden, resilience and anxiety/depression. The bootstrap method implemented in IBM SPSS AMOS 26.0 was used to estimate the mediating effect of resilience. All tests were two tailed, and results were considered significant at *p* values of 0.05.

## Results

### Demographic and Clinical Characteristics

As shown in [Table 1](#), the mean age of the participants was 57.70 (SD = 12.60) years, with a range of 28–85 years, and the median duration of disease diagnosis was 0.80 (IQR = 0.70) months. Most of the patients were male (77.13%) and had junior high school education or below (76.23%).

### Differences in Anxiety/Depression by Demographic and Clinical Features

Significant differences were found in anxiety/depression according to marital status and economic stress ([Table 2](#)).

### Descriptive Statistics and Correlations of Variables

As shown in [Appendix 1](#), the mean HADS score was  $12.37 \pm 6.03$  points, the mean anxiety score was  $6.21 \pm 3.11$  points, and the mean depression score was  $6.16 \pm 3.23$  points in postoperative PLC patients. Among these patients, 34.98% had anxiety, and 28.70% had depression (HADS subscale scores  $\geq 8$  points). The mean CD-RISC score was  $73.40 \pm 11.13$  points, the mean tenacity score was  $36.96 \pm 6.86$  points, the mean strength score was  $25.44 \pm 3.90$  points, and the mean optimism score was  $11.00 \pm 1.82$  points. The mean MDASI score was  $68.55 \pm 15.79$  points, the mean MDASI-Part I score was  $37.68 \pm 11.59$  points, and the mean MDASI-Part II score was  $30.87 \pm 6.21$  points. The six symptoms with the highest average severity were fatigue ( $6.11 \pm 1.86$ ), dry mouth ( $6.03 \pm 1.69$ ), pain ( $5.97 \pm 1.53$ ), lack of appetite ( $3.56 \pm 1.62$ ), drowsiness ( $3.49 \pm 2.28$ ), and disturbed sleep ( $3.44 \pm 1.86$ ). The six symptoms with the highest incidence were pain (100%), fatigue (100%), dry mouth (99.55%), lack of appetite (99.10%), drowsiness (88.34%), and distress (87.89%). The postoperative symptom burden of PLC patients is mainly involves distress with physical function, which is a systemic manifestation.

Pearson correlation analysis showed that anxiety/depression was significantly and negatively correlated with resilience in postoperative PLC patients ( $r = -0.41$ ,  $p < 0.05$ ). In addition, anxiety/depression was significantly and positively associated with symptom burden ( $r = 0.57$ ,  $p < 0.05$ ). As shown in [Table 3](#).

## Model Test

We used SEM in SPSS Amos to test the relationships among anxiety/depression, resilience, and symptom burden. The goodness-of-fit indices ( $\chi^2/df = 2.72$ , SRMR = 0.04, RMSEA = 0.09, GFI = 0.98, NFI = 0.97, TLI = 0.96, and CFI = 0.98) indicated that the model fit was satisfactory. Based on the model fitting results, the bias-corrected percentile method was used to test for mediating effects. Symptom burden significantly and negatively predicted resilience ( $\beta = -2.42$ ,  $p < 0.01$ ), symptom

**Table 1** Demographic and Clinical Characteristics of Participants (N = 223)

Variable	n	%	Mean ± SD/Median (IQR)
Age (years)			57.70 ± 12.60
Age (years)			
≤ 44	35	15.70	
45–60	97	43.50	
≥ 60	91	40.81	
Sex			
Male	172	77.13	
Female	51	22.87	
Residence			
City	56	25.11	
Countryside	167	74.89	
Marital status			
Unmarried	6	2.69	
Married	217	97.31	
Education level			
Primary school and below	87	39.01	
Junior high	83	37.22	
Senior high or above	53	23.77	
Economic stress			
Severe	25	11.21	
Moderate	129	57.85	
Mild	69	30.94	
Time since diagnosis (months)			0.80 (0.70)
Time since diagnosis (months)			
< 1	115	51.57	
1–3	71	31.84	
≥ 3	37	19.59	
History of hepatitis			
Yes	143	64.13	
No	80	35.87	
History of cirrhosis			
Yes	56	25.11	
No	167	74.89	

**Abbreviations:** SD, standard deviation; IQR, interquartile range.

burden significantly and positively predicted anxiety/depression ( $\beta = 0.25$ ,  $p < 0.01$ ), and resilience significantly and negatively predicted anxiety/depression ( $\beta = -0.02$ ,  $p < 0.01$ ). The results also showed that the indirect effect of symptom burden on anxiety/depression through resilience was 0.04 ( $p < 0.05$ ), with a 95% confidence interval (5000 samples) of [0.01–0.08]. Since this confidence interval did not include zero, we concluded that resilience had a significant mediating effect on the relationship of symptom burden with anxiety/depression; the indirect effect, as a proportion of the total effect, was 13.79% (Figure 1).

## Discussion

### Current Status of Symptom Burden, and Anxiety/Depression in Postoperative PLC Patients

The mean MDASI score was  $68.55 \pm 15.79$  points, and the mean MDASI-Part II score was  $30.87 \pm 6.21$  points. Up to 9 out of the 13 symptoms in the MDASI scale were present in over 50% of the patients, with 47% of patients scoring  $\geq 7$  on at least one symptom. This suggests considerable disruption in the patient's daily life. Wang et al enrolled 150 patients who underwent hepatectomy in order to validate a patient-reported outcome tool for perioperative care. The study found that over 50% of patients experienced 9 of the 13 symptoms included in the MDASI scale before discharge, and

**Table 2** Differences in Anxiety/Depression by Demographic and Clinical Features (N = 223)

	Anxiety and Depression	
	Mean $\pm$ SD/Median (IQR)	Z/H
Age (years)		0.44 <sup>a</sup>
$\leq$ 44	10.00 (9.00)	
45–60	12.24 $\pm$ 6.14	
$\geq$ 60	12.00 (9.00)	
Sex		-1.50 <sup>b</sup>
Male	11.50 (8.00)	
Female	13.00 (11.00)	
Residence		-1.91 <sup>b</sup>
City	10.00 (5.00)	
Countryside	12.00 (9.00)	
Marital status		-2.49 <sup>*b</sup>
Unmarried	19.00 (4.00)	
Married	11.00 (8.00)	
Education level		4.41 <sup>a</sup>
Primary school and below	12.00 (6.00)	
Junior high	12.00 (10.00)	
Senior high or above	10.00 (5.50)	
Economic stress		12.65 <sup>**a</sup>
Severe	13.00 $\pm$ 6.19	
Moderate	13.00 (7.50)	
Mild	10.16 $\pm$ 4.22	
Time since diagnosis (months)		4.77 <sup>a</sup>
$<$ 1	11.00 (7.00)	
1–3	12.00 (9.00)	
$\geq$ 3	12.76 $\pm$ 5.50	
History of hepatitis		-1.45 <sup>b</sup>
Yes	12.00 (8.00)	
No	11.33 $\pm$ 5.53	
History of cirrhosis		-0.22 <sup>b</sup>
Yes	12.00 (10.00)	
No	11.00 (8.00)	

**Notes:** a, Kruskal–Wallis *H*-test; b, Wilcoxon rank-sum test; \**p* value  $<$  0.05; \*\**p* value  $<$  0.01.

**Abbreviations:** SD, standard deviation; IQR, interquartile range.

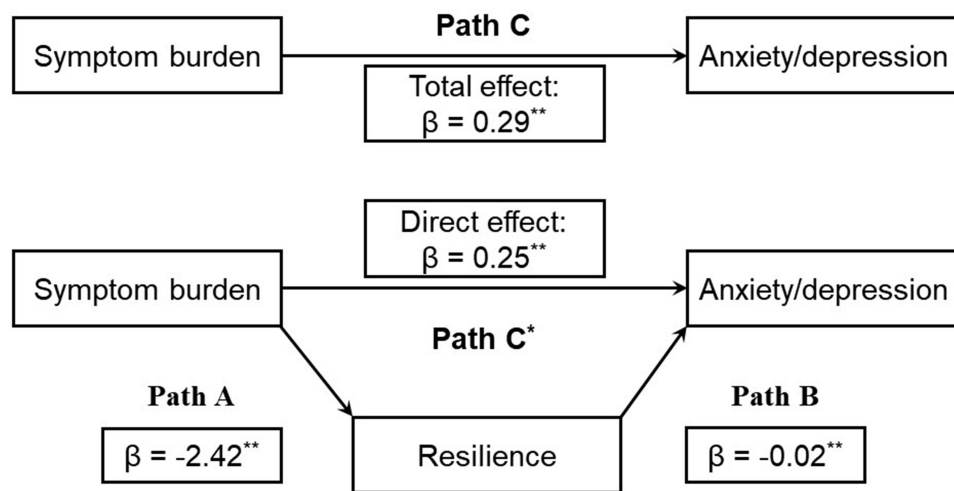
**Table 3** Descriptive Statistics and Correlations of Variables (N = 223)

Variables	Mean $\pm$ SD	Symptom Burden	Resilience	Anxiety/Depression
		r	r	r
Symptom burden	68.55 $\pm$ 15.79	1		
Resilience	73.40 $\pm$ 11.13	-0.31*	1	
Anxiety/depression	12.37 $\pm$ 6.03	0.57*	-0.41*	1

**Note:** \**p* value  $<$  0.05.

**Abbreviations:** SD, standard deviation; r, Pearson's correlation coefficient.

a significant 46.7% of patients experienced at least one severe symptom (score  $\geq$  7) that significantly affected their daily life.<sup>38</sup> These findings align with our research. In addition, we found that the six symptoms with the highest incidence and severity among PLC patients were mainly involved in distress with physical function, such as fatigue, dry mouth, pain,



**Figure 1** Model of the mediating effect of resilience on the association of symptom burden with anxiety/depression. \*\*p value < 0.01, \*p value < 0.05. Values on paths are path coefficients (non-standardized  $\beta$ s).

lack of appetite, drowsiness and disturbed sleep. All of these symptoms cause distress and dysfunction in the body and affect the patient's daily life. Patients with PLC experienced a significant symptom burden after hepatectomy that severely impacted their daily life. Symptomatic interventions for PLC patients after hepatectomy are urgently needed. The investigation into cancer symptom intervention in China commenced belatedly,<sup>39</sup> with a predominant emphasis on singular symptom following hepatectomy.<sup>40,41</sup> In recent years, a few researchers have started to acknowledge the significance of core symptoms and carried out studies.<sup>42,43</sup> Of these, most scholars define core symptoms as those with the highest incidence or severity.<sup>44,45</sup> It is suggested that medical staff pay close attention to the occurrence and severity of symptoms in postoperative PLC patients, conduct systematic and continuous assessment of various symptoms, especially the core symptoms, provide timely and appropriate interventions when symptoms cause distress.

The mean HADS score was  $12.37 \pm 6.03$  points, the mean anxiety score was  $6.21 \pm 3.11$  points, and the mean depression score was  $6.16 \pm 3.23$  points in postoperative PLC patients. Among these patients, 34.98% had anxiety, and 28.70% had depression (subscale scores  $\geq 8$  points), consistent with the results of Yu<sup>46,47</sup> et al but higher than the domestic norm.<sup>48</sup> In addition, significant differences were found in anxiety/depression according to marital status and economic stress. The study indicated that patients who are unmarried have noticeably higher levels of anxiety/depression in comparison to those who are married. Additionally, patients who experience severe economic stress exhibit significantly higher levels of anxiety/depression than those who experience mild economic stress. The reasons for this discrepancy may be that the patients in this study were mainly middle-aged and elderly men (84.30%), who are the backbone of the family and the main income earners. However, due to the poor prognosis of the disease, the disease itself and the adverse effects of treatment, patients often experience anxiety, depression and other psychological problems. In addition, patients often worry that the cancer cannot be cured and will have a negative impact on their family, aggravating their anxiety and depression levels. Patients who are married, they may receive more family support than unmarried patients, potentially leading to an improvement in their anxiety/depression. For such patients, the medical staff should describe the recovery experience of patients after undergoing similar surgeries and encourage patients to feel confident in the likelihood of overcoming the disease. In addition, medical staff should guide patients' families to provide good social support.

## Associations Among Symptom Burden, Resilience and Anxiety/Depression in Postoperative PLC Patients

Our findings support the hypothesis that a lighter symptom burden and higher resilience may reduce anxiety/depression in patients. This study demonstrates that symptom burden not only has a direct effect on anxiety/depression, but also has an indirect effect on anxiety/depression through resilience. Correlation analyses further revealed that resilience partially mediates the relationship between symptom burden and anxiety/depression in postoperative PLC patients. A heavy symptom burden leads to serious distress in the patient's physical function, which affects daily life, resulting in worry, depression, and unpleasant

sensations. If these feelings are not addressed, they can lead to psychological problems such as anxiety/depression. Studies have found that a lighter symptom burden can promote resilience in patients, help them to regulate themselves, stimulate positive emotions, and reduce anxiety and depression.<sup>49</sup> However, a heavy symptom burden leads to severe distress, a weaker ability to quickly adapt to and change stressful external and internal situations, a lower level of self-regulation, and an inability to maintain mental health. Therefore, the heavier the symptom burden is, the lower the resilience of the patient, and the less likely they are to maintain good mental health, leading to anxiety/depression. Improving the patient's resilience can alleviate anxiety/depression. Studies have shown that resilience, which is an important psychological intervention target, can be improved by focusing on the solution model and positive psychological intervention.<sup>50</sup> Therefore, it is suggested that different interventions should be used to improve the resilience of patients, thereby reducing their level of anxiety/depression.

Surprisingly, the mediating effect of resilience on the relationship of symptom burden with anxiety/depression in postoperative PLC patients explained only 13.79% of the variance, and the direct effect of symptom burden on anxiety/depression was as high as 86.21%. We speculate that this finding may be because the included subjects being postoperative PLC patients, and their psychological state is closely related to the disease itself. The significant burden of symptoms experienced by postoperative PLC patients results in significant disruptions to their daily lives, uncertainty, and changes to their physical bodies,<sup>51</sup> all of which contribute to the development of anxiety/depression. While resilience can assist individuals in effectively coping with adversity and stress, its potential to mediate the impact of such substantial life changes and discomfort may be limited. Studies have found that the application of a combined intervention model of psychological intervention combined with nutrition and exercise interventions is significant for tumor patients.<sup>52,53</sup> Therefore, joint symptom-psychological interventions focusing on symptoms should be considered for patients with PLC after hepatectomy to reduce the level of anxiety/depression in patients. In the clinical setting, it is recommended that medical staff pay close attention to the presence and severity of anxiety/depression in patients with PLC after hepatectomy, in addition to symptom burden. Additionally, medical staff should explain to the patients the reason why these symptoms occur in order to alleviate the worries and fears caused by the symptoms. Furthermore, patients should be encouraged to express their inner emotions and actively seek help from medical staff when they are anxious or worried about the disease or treatment. When interventions are necessary to alleviate anxiety and depression, joint symptom-psychological interventions focusing on symptoms should be considered.

## Study Limitations

This study was a cross-sectional survey. Using a structural equation model can only test the correlation between variables but cannot prove the causal relationship between variables. The mediating role of resilience should be verified longitudinally. Additionally, the study employed convenience sampling to recruit participants, a method that is easy to apply but carries limitations such as high sampling bias, low representativeness, and an inability to accurately extrapolate to the wider population. In this study, we included only a few disease-related characteristics such as hepatitis and cirrhosis, and did not consider other factors of patient's basic health status such as comorbidities and complications, which may not be comprehensive enough for the analysis of anxiety/depression.

## Clinical Implications

Compared with the mediating effect of resilience, the various symptoms of the disease and treatment have a greater impact on the anxiety/depression in patients with PLC after hepatectomy. Consequently, joint symptom-psychological interventions focusing on symptoms should be considered for patients with PLC after hepatectomy, rather than focusing primarily on resilience interventions. Nevertheless, patients after hepatectomy typically encounter multiple interrelated symptoms. Medical staff often have limited time and energy to address all of the symptoms experienced by patients. Therefore, it is important to prioritize the symptoms that are most significant and require immediate attention. It is crucial to closely observe the occurrence and severity of core symptoms. Provide timely and appropriate interventions from the perspective of core symptoms when symptoms cause distress to minimize the patient's symptom burden and ultimately alleviate the patient's level of anxiety/depression, and to promote physical and psychological recovery.



## Conclusion

The levels of anxiety/depression and symptom burden in patients with PLC after hepatectomy should be improved. Lower anxiety/depression is associated with a lighter symptom burden and higher resilience in patients. Resilience was found to partially mediate the relationship of symptom burden with anxiety/depression, but the mediation effect was much lower than the direct effect of symptom burden on anxiety/depression. It has been demonstrated that joint symptom-psychological interventions focusing on symptoms should be considered for patients with PLC after hepatectomy, rather than focusing primarily on resilience interventions. This combined intervention can alleviate patients' heavy symptom burden and anxiety/depression level, thereby promoting their physical and psychological recovery. Considering the numerous symptoms experienced by patients after hepatectomy, and the limited availability of time and energy for medical staff, exploring symptom intervention from the core symptoms perspective is warranted.

## Ethics Approval and Informed Consent

This study was approved by the Ethics Committee of Anhui Medical University (No. 84220046).

## Consent for Publication

Written informed consent for publication of their details was obtained from the patient.

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## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors report no conflicts of interest in this work.

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