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The Effect of Family Function on Fear of Cancer Recurrence in Patients after Liver Cancer Surgery: The Mediating Effect of Self-Efficacy

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Abstract: Our study aims to explore the mediating effect of self-efficacy between family function and fear of cancer recurrence in patients after liver cancer surgery. A convenience sampling method was used to select 128 patients who underwent liver cancer surgery at a grade A level III hospital in Ganzhou City from February 2024 to December 2024 as the research subjects. The Chinese version of the Self-Management Efficacy Scale for Cancer Patients (SUP-PH), the Family Care Index Questionnaire (APGAR), and the Simplified Fear of Progression Questionnaire (Fop-Q-SF) were employed for the survey, and the mediating effect analysis was conducted. RESULTS: The self-management efficacy score of patients after liver cancer surgery was (72.64±11.04) points, the family care index score was (7.00±1.00) points, and the fear of progression score was (36.51±5.40) points. The family function and self-efficacy of patients after liver cancer surgery were negatively correlated with fear of cancer recurrence (P<0.01), and self-efficacy was positively correlated with family function (P<0.01). The results showed that the total effect value was -0.766, the direct effect of family function on fear of cancer recurrence was significant (β=-0.416, 95%CI: -0.256~-0.124, P<0.01), and self-efficacy played a partial mediating role between family function and fear of cancer recurrence (β=-0.350, 95%CI: -0.312~-0.119); the mediating effect accounted for 45.69% of the total effect. There is a correlation among self-efficacy of liver cancer patients, patient family function, and fear of cancer recurrence. Self-efficacy can partially mediate the influence of family function on fear of cancer recurrence, and improving the level of patients' self-efficacy is conducive to alleviating their fear of cancer recurrence.

1. Introduction

Hepatocellular carcinoma is a common malignant tumor, and the incidence of hepatocellular carcinoma is characterized by significant geographic differences worldwide. Asian and African countries are regions with a high incidence of liver cancer, with China, Southeast Asia, and sub-Saharan Africa particularly affected, This is associated with high rates of local hepatitis virus infection, particularly hepatitis B and C viruses[1]. Risk factors for hepatocellular carcinoma include

hepatitis virus infection, alcohol abuse, non-alcoholic fatty liver disease, cirrhosis, tobacco use, aflatoxin-contaminated food intake and exposure to certain chemicals[2].Hepatitis virus infection is the main risk factor for hepatocellular carcinoma, and the risk of hepatocellular carcinoma is significantly increased in patients with hepatitis B and C virus infections, alcohol abuse damages the liver, and prolonged alcohol consumption leads to cirrhosis of the liver, which in turn increases the risk of hepatocellular carcinoma, and nonalcoholic steatohepatopathy, a chronic liver disease caused by the accumulation of fat in the liver, is also considered one of the important risk factors for hepatocellular carcinoma[3-5]. In addition to viral infections and liver disease, genetic and environmental factors may also play a role in the development of liver cancer, some populations carry certain genetic variants, such as mutations in liver cancer-related genes, which increase the risk of liver cancer[6]. While long-term exposure to certain chemicals and toxins, such as aflatoxin, may also contribute to the development of liver cancer[7].

Family is the basic unit of a person's life, and family functioning has an important impact on patients' quality of life and psychological health[8, 9]. Postoperative patients with hepatocellular carcinoma often need support and care from family members, and good family functioning can provide the necessary support and care to facilitate recovery and adaptation[10, 11]. Liver cancer patients face the risk of cancer recurrence after surgery, which may lead to the development of cancer recurrence fear. Fear of cancer recurrence is often accompanied by negative emotions such as anxiety and depression, which may affect patients' family functioning [12]. Fear can lead to depressed mood and self-isolation, which in turn affects the way of communicating and getting along with family members and adversely affects family harmony and stability [13].

Self-efficacy refers to an individual's belief in his or her ability to accomplish a specific task. Self-efficacy in postoperative hepatocellular carcinoma patients may have a significant impact on their adaptation to postoperative life and recovery[14]. Patients with high self-efficacy are more likely to take positive actions to cope with postoperative difficulties and challenges and to improve their recovery [15]. Self-efficacy may play a mediating role between family functioning and fear of cancer recurrence in postoperative patients with hepatocellular carcinoma. Patients with higher self-efficacy are more likely to take positive actions to improve family functioning and establish good communication and supportive relationships with family members, thereby reducing the fear of cancer recurrence [16]. Self-efficacy indirectly affects family functioning and fear of cancer recurrence by influencing patients' behavioral patterns and psychological states. In this paper, we will explore the mediating effect of self-efficacy between family functioning and fear of cancer recurrence in postoperative hepatocellular carcinoma patients with the aim of gaining insights into and improving mental health and family functioning in postoperative hepatocellular carcinoma patients.

2. Objects and Research Methods

2.1 Study subjects

128 cases of primary liver cancer patients who underwent surgical treatment in our hospital from September 2023 to June 2024 were selected as the study subjects. Inclusion criteria: conforming to the disease diagnosis in the Diagnostic and Treatment Criteria for Primary Liver Cancer (2022 Edition); age ≥ 18 years; normal mental status; clear condition by imaging and pathological examination; informed consent of the patients and their families. Exclusion criteria: secondary hepatocellular carcinoma; presence of recurrence or distant metastasis of hepatocellular carcinoma; accompanied by other malignant tumors; cardiopulmonary dysfunction. The study was approved by the Hospital Ethics Committee(serial number: LLSC-2023 No. 396).

2.2 Methodology

2.2.1 General information questionnaire

General patient information was collected by uniformly trained investigators using a self-administered questionnaire. The questionnaire included basic information on the patient's gender, age, body mass index, marital status, education level, monthly household income, clinical stage, type of pathology, and length of hospitalization. In this study, 128 questionnaires were distributed and 128 valid questionnaires were recovered, with a valid recovery rate of 100. 0%.

2.2.2 Self-efficacy assessment methods

The Chinese version of the Self-Management Efficacy Scale for Cancer Patients (SUP-PH), which includes 3 dimensions and 28 items, each item is evaluated on a 5-point scale, corresponding to a score of 1-5, and the higher the total score is, the higher the level of self-efficacy is, and a total score of ≥103 is high self-efficacy, 66-102 is moderate self-efficacy, and ≤65 is poor self-efficacy. The Cronbach's alpha coefficient for this scale was 0.98[17].

2.2.3 Methods for assessing family caringness

Family Caringness Index Questionnaire (AP-CAR), the scale is used to evaluate family functioning, including family adaptability, adulthood, cooperation, intimacy and emotionality, with five entries, each with a score of 0-2, and a total score of 7-10 as good family functioning, 4-6 as moderate family dysfunction, and 0-3 as severe family dysfunction. The scale had a Cronbach's alpha coefficient of 0.87 and a retest reliability coefficient of 0.80-0.83[18].

2.2.4 Methods for assessing fear of cancer recurrence

Fear of Disease Progression Scale (Fop-Q-SF), a scale used to evaluate the fear of cancer recurrence, consists of 12 entries, including two dimensions of social family and physical health, each entry is scored from 1-5 points, and is bounded by a total score of ≥34 points, with higher scores being associated with more severe fear of cancer recurrence. The scale had a Cronbach's alpha coefficient of 0.88 and a retest reliability coefficient of 0.85[19].

2.3 Statistical processing

The raw data were entered into Excel software statistics, and the data were analyzed by using SPSS 22.0 software and AMOS 26. 0 software, the count data were expressed as percentages with $\chi 2$ test; the measurement data were expressed as "± s" with t test; the correlation analysis between variables was performed with Pearson analysis; the structural equation model was established by using AMOS 26.0, and the mediating effect was tested and verified by Bootstrap method. AMOS 26.0 was used to establish structural equation modeling, and Bootstrap method was used to test and validate the mediation effect. P<0. 05 was taken as the difference was statistically significant.

3. Results

This study included 128 postoperative patients with hepatocellular carcinoma were included in this study, including 70 males (54.7%) and 58 females (45.3%); their ages ranged from 38 to 86 years old, with a mean age of (52.46±10.84) years, and their general demographic information is detailed in Table 1.

Table 1: General demographic information (n, %)

Sports event	Form	Number of examples	Percentage
Distinguishing between the sexes	Male	70	54.7%
	Female	58	45.3%
Age (years)	<60	92	71.9%
	≥60	36	28.1%
Marital status	married	94	73.4%
	Other (Unmarried, Divorced, Widowed)	34	26.6%
Educational attainment	Primary and below	16	12.5%
	Junior high school	48	37.5%
	Secondary and high school	38	29.7%
	College and above	26	20.3%
Monthly per capita household income (yuan)	<3 000	44	34.4%
	3 000~5 000	62	48.4%
	>5 000	22	17.2%
Medical Payment Methods	Medical insurance/social security	96	75%
	Subsistence allowance	32	25%
Clinical staging(CNLC)	Stage II and below	82	64.1%
	Stage III	34	26.6%
	Stage IV	12	9.4%
Pathological type	hepatocellular carcinoma	64	50.0
	bile duct cell carcinoma	46	35.9
	mixed-cell carcinoma	18	14.1

3.1 Current status of postoperative self-efficacy among liver cancer patients

The results of this study showed that the Physical Health Dimension: the participants scored 22.34 on Physical Health. This indicates that they assessed their physical health status more positively. However, the range of this dimension from 18.99 to 25.69 suggests that there may be some variation in physical health status among patients. Social-family dimension: participants scored 15.23 on the social-family dimension. This score reflects patients' assessment of their social interactions and family functioning. Higher scores may imply that they perceived more adequate social and family support and understanding. Total Fear of Cancer Recurrence Score: Participants scored 36.51 for fear of cancer recurrence. This score reflects the patients' level of concern about cancer recurrence. Higher scores may indicate that patients have higher levels of fear and anxiety about cancer recurrence. Length of Growth, Emotionality, Cooperation, Adaptability and Intimacy: These dimensions measured the patients' scores on personal growth, emotional expression, cooperation, adaptability and intimacy respectively. Scores on all dimensions ranged from 1.00 to 2.00, indicating that participants' assessments in these areas were generally high. APGAR TOTAL SCORE: The APGAR total score of

7.00 reflects participants' overall scores on the Family Functioning Assessment. Higher scores may imply that patients perceive their families as supporting and functioning better for them. Positive Attitude, Self-Stress Reduction, and Self-Decision Making: these dimensions assessed participants' scores on Positive Attitude, Self-Stress Reduction, and Self-Decision Making, respectively. Positive attitude score was 39.51, which indicated that the patients had a more positive attitude to face cancer treatment. Self-stress reduction score was 27.26, reflecting the patients' assessment in reducing their own stress. The self-decision score of 8.35 indicated that the patient had a high assessment in personal decision-making ability. Total self-efficacy score: The total self-efficacy score of 72.64 reflects the patient's assessment of his/her competence and confidence in facing the cancer treatment and recovery process, see in Table 2. Higher scores may imply that patients hold greater confidence in their abilities and coping strategies. These scores provide some information about the psychological and emotional state of patients undergoing radiotherapy for liver cancer. These results can help healthcare professionals better understand patients' needs and provide them with more appropriate support and interventions to improve their self-efficacy and mental health.

Table 2: Self-efficacy, family functioning, and fear of cancer recurrence scores of liver cancer patients ($x \pm s$)

Items	Actual score
Physiological health dimension	22.34±3.85
Social family dimension	15.23±2.47
Total Fear of Cancer Recurrence Score	36.51±5.40
Length of formation	1.00±0.50
Sentimentality	2.00±0.50
Degree of cooperation	2.00±0.50
Degree of adaptation	1.00±0.50
Intimacy	1.00±0.50
Total APGAR score	7.00±1.00
Positive attitude	39.51±4.31
Self-decompression	27.26±4.15
Self-determination	8.35±2.16
Total self-efficacy score	72.64±11.04

3.2 Linear regression analysis

The results of the regression analysis showed that Positive Attitude: this item showed a negative correlation with several dimensions. This means that the dimensions of physical health, social and family relationships, fear of cancer recurrence, personal growth, emotional experience, cooperation, adaptability, and intimacy scored lower in the presence of higher positive attitudes. This may indicate some dichotomy between positive attitudes and individuals' perceptions of facing physical health problems, social support, emotional exhaustion, and self-efficacy. Emotional Exhaustion (EE): there was also a negative correlation between emotional exhaustion and the dimensions. This means that when emotional exhaustion was high, individuals scored lower on physical health, social and family relationships, fear of cancer recurrence, personal growth, emotional experience, cooperation, and adaptability. This may suggest that emotional exhaustion negatively affects an individual's overall well-being and general competence. Self-Relaxation: There was also a negative correlation between self-relaxation and each dimension. This means that individuals with higher self-relaxation scores had lower scores on physical health, social-family relationships, fear of cancer recurrence, personal growth, emotional experience, cooperation, and adaptability. This may indicate some negative

correlation between self-stress reduction and individuals' ability to cope with stress, establish healthy social relationships, and adapt to the environment. Self-Determination: There is also a negative correlation between self-determination and the dimensions. This means that individuals with higher self-determination scores have lower scores on physical health, social and family relationships, fear of cancer recurrence, personal growth, emotional experience, cooperation, and adaptability. This may indicate that there is some dichotomy between self-decision-making ability and individuals' health management, social interaction, emotional experience, and adaptability. Self-Efficacy Total Score: There was also a negative correlation between the Self-Efficacy Total Score and the dimensions. This means that individuals with higher Self-Efficacy Total Scores had lower scores on Physical Health, Social-Family Relationships, Fear of Cancer Recurrence, Personal Growth, Emotional Experiences, and Collaborative Skills. This may indicate some dichotomous relationship between total self-efficacy scores and an individual's self-perceived and synthesized competence in multiple dimensions.

In addition, we observed correlations between the dimensions. These correlations could provide some information about their interactions: length of accomplishment was positively correlated with total APGAR score, affectivity, adaptability and intimacy. This could mean that there is some similarity between the positive experiences and subjective feelings of individuals in terms of length of achievement and overall well-being, affective experience, adaptability, and intimacy. Affectivity was positively correlated with total APGAR score, adaptability and intimacy. This suggests that there may be a correlation between increased emotionality and individual overall well-being, adaptive capacity and intimacy. Cooperativeness was positively correlated with APGAR total score, adaptability and intimacy. This may imply that there is some association between an individual's positive experience with cooperativeness and overall well-being, adaptability, and intimacy. Adaptability was positively correlated with APGAR total score. This suggests that there may be some similarity between increased adaptive capacity and an individual's overall well-being. Intimacy was positively correlated with the total APGAR score. This may imply that there is some association between increased intimacy and overall individual well-being, see Table 3.

Table 3 Correlation analysis of self-efficacy with family functioning and fear of cancer recurrence scores in liver cancer radiotherapy patients

Items	Positive attitude	Emotionally draining	Self-decompression	Self-determination	Total Self-efficacy score
Physiological health dimension	-0.412**	-0.391**	-0.415**	-0.461**	-0.352*
Social family dimension	-0.404*	-0.429**	-0.437**	-0.435**	-0.368**
Total Fear of Cancer Recurrence Score	-0.452**	-0.384**	-0.339*	-0.371**	-0.442**
Length of formation	0.427*	0.198*	0.284*	0.431*	0.429*
Sentimentality	0.461*	0.437*	0.134**	0.315*	0.453**
Degree of cooperation	0.179**	0.397*	0.233*	0.412*	0.318*
Degree of adaptation	0.217*	0.275**	0.365*	0.480*	0.172**
Intimacy	0.205*	0.346*	0.376**	0.375*	0.237
Total APGAR score	0.435**	0.392**	0.382**	0.412**	0.620**

3.3 Mediating effects of self-efficacy between family functioning and fear of cancer recurrence in hepatocellular carcinoma patients

Structural equation modeling was used to explore the pathways of self-efficacy between family functioning and fear of cancer recurrence and to verify the mediating role of self-efficacy between family functioning and fear of cancer recurrence. Structural equation modeling was established with family functioning as the independent variable, self-efficacy as the mediator variable, and fear of cancer recurrence as the effect variable in liver cancer patients, as shown in Table 4 and Figure 1. Family functioning negatively predicted fear of cancer recurrence, with a direct effect of -0. 416, and

self-efficacy negatively predicted fear of cancer recurrence, with an effect value of -0. 458.Family functioning indirectly predicted fear of cancer recurrence through self-efficacy, with a mediating effect of 0. 764 × (-0. 458) = -0. 350. The total effect is (-0.416) + (-0.350) = -0.766, with the mediating effect accounting for 45.69% of the total effect. Using the Bootstrap method to validate the mediating effects, neither the direct effect of family functioning on fear of cancer recurrence nor the indirect effect of self-efficacy contained 0 within the 95% CI, suggesting that family functioning not only directly influences the level of fear of cancer recurrence progression, but also influences the level of fear of cancer recurrence progression through the mediating effect of self-efficacy. See Table 5.

Table 4 Analysis of mediating effect of self-efficacy between family functioning and fear of cancer recurrence in patients with liver cancer (n=128)

Step	implicit variable	independent variable	regression coefficient	standard error	path factor	t-value	P-value
Step 1	Fear of Cancer Recurrence	family function	-0.341	0.064	0.182	-5.147	<0.01
Step 2	self-efficacy	family function	0.286	0.042	0.014	2.354	0.038
Step 3	Fear of Cancer Recurrence	Feelings of self-efficacy	-0.261	0.010	0.213	-6.178	<0.01
		family function			0.274	-4.152	<0.01

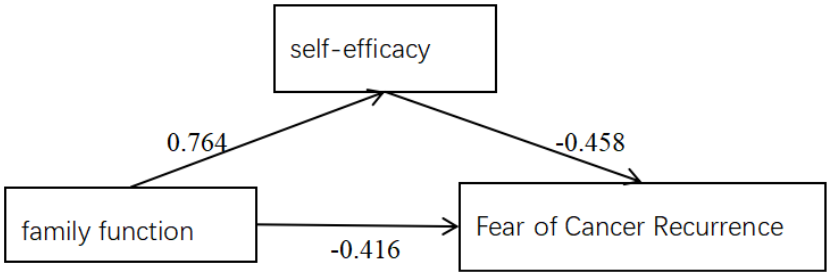

Figure 1: A mediation model of self-efficacy between family functioning and fear of cancer recurrence in patients with hepatocellular carcinoma

Table 5: Decomposition of the total, direct, and mediating effects of family functioning on fear of cancer recurrence and self-efficacy

sports event	efficiency value	Relative effect value (%)	Boot standard error	P-value	95%CI
aggregate effect	-0.766	--	0.018	<0.01	-0.217~-0.084
direct effect	-0.416	53.31	0.058	<0.01	-0.256~-0.124
indirect effect	-0.350	45.69	0.062	<0.01	-0.312~-0.119

4. Discussions

Hepatocellular carcinoma is a serious malignant tumor, and as a disease with a highly malignant and complex course, it has a tremendous impact on the life and mental health of patients [20]. It poses a great threat to physical health and life functions. Postoperative patients usually need to undergo a long-term rehabilitation and therapeutic process, in which the support and stabilization of family functioning plays a crucial role[21, 22]. In this study, we conducted a comprehensive analysis of family functioning, self-efficacy, and fear of cancer recurrence in postoperative patients with hepatocellular carcinoma, aiming to reveal their relationships and the mediating effect of self-efficacy in them. The following discussion will be divided into three parts.

The results of our study showed that the physical health dimension score was 22.34, indicating a positive assessment of physical condition. The social-family dimension score was 15.23, reflecting an assessment of social interactions and family functioning. The total score for fear of cancer

recurrence was 36.51, indicating a high level of concern about recurrence. The other dimensions (adulthood, affectivity, cooperation, adjustment, and intimacy) had scores ranging from 1.00 to 2.00, which were generally assessed as high. The APGAR total score of 7.00 indicated a good score on the assessment of family functioning. Positive attitude score of 39.51, self-stress reduction score of 27.26, self-decision making score of 8.35, and total self-efficacy score of 72.64 indicated high positive attitude, stress reduction ability, and self-confidence. Therefore, for patients with weak family function, we should pay attention and take measures to provide more comprehensive and targeted support and care to promote their recovery and quality of life. Second, self-efficacy plays an important role in the psychological state and recovery process of liver cancer patients. Self-efficacy refers to an individual's perception of his or her confidence and ability to accomplish specific tasks or cope with difficult situations[23]. In this study, we found that the results of regression analysis showed the following relationship: positive attitude was negatively correlated with several dimensions, indicating that when positive attitude was higher, scores on other dimensions were lower. Emotional exhaustion, self-stress reduction, self-decision making, and total self-efficacy scores were negatively correlated with each dimension, indicating that when these competencies were higher, the other dimensions scored lower. In addition, the length of adulthood was positively correlated with the total APGAR score, affectivity, cooperation, adaptability, and intimacy. Affectivity and cooperation were positively correlated with APGAR total score, adaptability and intimacy. Adaptability and intimacy were positively correlated with APGAR total score, which is consistent with the findings of existing studies[24, 25]. This may be due to the fact that improved self-efficacy enhances patients' ability to face difficulties and challenges, making them more confident and motivated to cope with various demands and pressures during the rehabilitation process. In addition, the support and stability of family function can also provide patients with better psychological support and rehabilitation environment, which can further enhance their self-efficacy. Therefore, we can conclude that self-efficacy plays an important mediating role between family functioning and fear of cancer recurrence in postoperative liver cancer patients.

In summary, this study revealed the correlation between family functioning, self-efficacy and fear of cancer recurrence in postoperative hepatocellular carcinoma patients, and further elucidated the mediating effect of self-efficacy in this context. These findings provide valuable references for clinical staff and family members to improve patients' recovery and quality of life. For patients with weak family function, family support and care should be strengthened to provide more comprehensive and targeted rehabilitation services. Meanwhile, by enhancing patients' self-efficacy, their rehabilitation process and coping ability can be further promoted to alleviate the impact of fear of cancer recurrence. However, there are some limitations in this study, such as sample selection and the use of survey instruments, and further research is needed to validate and extend these findings.

Data availability statement

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to confidential participant information. Requests to access these datasets should be directed to GY, 15810583168@163.com.

Ethics statement

This study was approved by the Research Ethics Committee of REDACTED (LLSC-2023 No. 396). All participants consented to the study verbally and in writing.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Author Contributions

SH: project administration, writing-original draft, methodology, and data analysis. LZ: literature review. DH: questionnaire survey. YL: supervision and editing. All authors contributed equally to the article and approved the submitted version.

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