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Original Article

Factors influencing fear of disease recurrence in postoperative craniopharyngioma patients

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Abstract: Objective: To investigate the factors influencing the fear of recurrence among craniopharyngioma (CP) patients. Methods: A total of 152 CP patients from Mianyang Central Hospital were recruited for this survey. The patients completed validated self-report questionnaires, including the Fear of Progression Questionnaire-Short Form (FoP-Q-SF), Hospital Anxiety and Depressed Scale (HADS), Social Support Rating Scale (SSRS), and Simplified Coping Style Questionnaire (SCSQ). Results: The average post-surgery FoP-Q-SF score in CP patients was 36.29±5.22 points, with 71.1% of patients scoring above the clinical significance level (cut-off score ≥34). FoP-Q-SF scores differed significantly by type of resection, gender, and tumor size (P<0.001), with lower recurrence fear in patients undergoing total resection, female patients, and those with tumors <2.4 cm. Social support (P<0.001) and positive coping (P<0.001) were associated with a significant reduction in the fear of recurrence, while negative coping was associated with an increased fear of recurrence (P<0.001). Additionally, gender (P<0.001) and tumor size (P<0.001) also showed significant effects on fear of recurrence. The interaction between depression and gender significantly affected fear of recurrence (P<0.001), with female FoP-Q-SF scores increasing as HADS-depression scores rose, while the opposite trend was observed for male patients. Conclusion: The interaction between gender and depressive mood significantly modulates the fear of recurrence, suggesting that gender differences should be considered in clinical interventions. Social support and positive coping play a positive role in alleviating fear of recurrence, while negative coping may exacerbate the fear. Strengthening psychological assessment and support during postoperative care is recommended.

Keywords: Fear of disease recurrence, craniopharyngioma, surgical treatment, coping mechanisms, postoperative care

Introduction

Craniopharyngiomas (CP) are slow-growing, benign central nervous system tumors located in the sellar or parasellar region. Despite their benign pathology, they are associated with a poor clinical prognosis. The incidence of CP peaks in the age groups of 5 to 15 years and 50 to 70 years, showing a bimodal age distribution [1]. Despite a five-year survival rate exceeding 90%, CPs are often considered chronic conditions because treatment does not always alleviate the symptoms caused by the tumor, and recurrence is common. Surgical intervention remains the primary treatment, but the postoperative recurrence rate is high, with a 40% recurrence rate in children and 6%-26% in adults [2, 3].

Recent studies have highlighted that one of the most common unmet needs and concerns among cancer survivors is the fear of disease recurrence or progression, which often has significant clinical and psychological effects,

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adversely affecting their daily lives [4, 5]. "Fear of recurrence" refers to the persistent anxiety and worry about the potential for disease recurrence or progression, which may emerge at diagnosis and persist throughout the patient's life. Beyond fear of recurrence, CP patients face multiple psychological stressors, including uncertainty about treatment outcome, challenges associated with endocrine replacement therapy, cognitive difficulties, and social integration difficulties. These stressors, combined with the physical manifestations of the disease, contribute to a complex psychosocial burden that requires comprehensive understanding and intervention.

Surgical treatment for CP remains a challenge for neurosurgeons; although it does not undergo malignant transformation, its difficult-to-cure characteristics results in biological behaviors similar to those of malignant tumors. Moreover, recurrent CP may adhere more tightly to surrounding vital structures, making complete resection more difficult. Therefore, CP patients not only have to deal with the stress brought by the tumor itself but also face additional challenges arising from poor prognosis [6], such as visual impairment, headaches, and endocrine dysfunction [7].

Against this backdrop, there is a high demand for psycho-oncology care among CP patients. A study shows that 29.4% of patients with benign intracranial tumors have symptoms of depression, and 17.6% exhibit symptoms of generalized anxiety disorder [6]. Fear of recurrence is positively correlated with depression and anxiety [8]. This study innovatively investigated thepsychological burden in CP patients, with a particular focus on fear of recurrence. Understanding these factors has immediate clinical applications, including: (1) development of targeted psychological interventions for CP patients, (2) establishment of screening protocols for psychological distress in CP care, and (3) creation of evidence-based guidelines for psychosocial support throughout the treatment.

However, there is a notable lack of data on the emotional suffering and psychological burden faced by CP patients. Therefore, this study primarily focused on the current state of fear of disease recurrence among CP patients and analyzed its influencing factors, thereby providing support for subsequent interventions and prevention of disease recurrence.

Patients and methods

Participants

Patients who underwent craniopharyngioma surgery at Mianyang Central Hospital from 2016 to 2024 were recruited to complete the questionnaire. All patients were diagnosed using cranial CT and MRI, with postoperative pathological results serving as the gold standard. Inclusion criteria: (1) treated with gross total resection (GTR) or subtotal resection (STR) as their first CP surgery; (2) postoperative tumor pathology confirmed as craniopharyngioma; (3) voluntarily participated in the survey and provided informed consent for inclusion in the study. Exclusion criteria: (1) concurrent severe diseases such as heart disease, severe pulmonary disease; (2) cognitive dysfunction; (3) inability to complete the questionnaire due to language barriers, vision or hearing impairments. This study was approved by the Ethics Committee of Mianyang Central Hospital.

Research tools

Basic information collection form: Gender, age, education level, tumor size, type of resection, tumor type, and source of medical expenses were collected.

Fear of progression questionnaire-short form (FoP-Q-SF): Developed by Mehnert et al. [9] as a simplified version of the Fear of Progression Questionnaire, this tool measures the level of fear of disease recurrence and progression. It consists of 12 items, using a Likert 5-point scale (1 to 5 points), with a total score ranging from 12 to 60. Higher scores indicate stronger fear, and a total score above 34 indicates clinical significance [10]. In 2015, Chinese scholar Qiyun Wu et al. [11] localized and validated the Chinese version, reporting a Cronbach's α of 0.883.

Hospital anxiety and depressed scale (HADS) [12]: This scale includes 14 questions, with 7 items each for anxiety and depression, scored on a Likert 4-point scale. The total score for each item ranges from 0 to 21, with a subscale score ≥8 indicating the presence of anxi-

ety or depression. The Cronbach's α coefficients for the Chinese version of the HADS, the anxiety subscale, and the depression subscale are 0.879, 0.806, and 0.806, respectively, with test-retest reliabilities of 0.945, 0.921, and 0.932 accordingly.

Social support rating scale (SSRS) [13]: This scale covers three dimensions, divided into objective support (3 items, 22 points), subjective support (4 items, 32 points), and the utilization of support (3 items, 12 points), totaling 10 items with a maximum score of 66 points. The Cronbach's α is 0.896.

Simplified coping style questionnaire (SCSQ): Revised by Jie Yaning et al. [14], this questionnaire assesses two dimensions with 20 items, including positive coping (12 items, 0-36 points) and negative coping (8 items, 0-24 points). Each item is scored on a Likert 4-point scale, ranging from "never" (0 points) to "often" (3 points). The Cronbach's α is 0.901.

Survey methodology

The survey was conducted by the researchers during outpatient follow-up visits. The purpose of the survey was explained to the patients face-to-face. Upon obtaining their consent, they were given a uniform set of instructions for completing the questionnaire independently, which they then returned on the spot. For underaged patients, the primary caregivers - typically their parents - assisted in completing the scale and questionnaire assessments. According to published literature [6], the incidence of psychosocial distress in patients with benign intracranial tumors is about 53%, with 29.4% having depressive symptoms, 17.6% having anxiety symptoms, 29.4% reporting clinically relevant post-traumatic stress symptoms, and 17.6% exhibiting somatic symptom burden. Therefore, in this study, the highest reported incidence rate of psychosocial distress, 53%, was used to estimate the sample size for this study. An allowable error margin was set at 8%, with a confidence level of 95% (1-α=0.95). Using PASS 21 software, the required sample size was calculated to be N=150 cases (formula is as follows). Considering a 10% sample attrition rate, the total sample size needed was adjusted to approximately 167 cases (calculated as N= 150/0.9). In the end, a total of 167 questionnaires were distributed, and 152 valid questionnaires were collected (valid recovery rate of 91.0%).

$$N = \frac{Z_{\alpha/2}^2 \times p \times (1 - p)}{d^2} \quad (1)$$

N: the required sample size. $Z_{\alpha/2}$: the critical value from the standard normal distribution corresponding to the confidence level (1-α). For a 95% confidence level, $Z_{0.025}$ is 1.96. p: the expected population proportion. d: the allowable error.

Statistical methods

Data analysis was conducted using SPSS version 27.0. Quantitative data following a normal distribution were presented as mean ± standard deviation (SD), and comparisons were made using t-tests or analysis of variance (ANOVA). Multiple stepwise linear regression analysis was employed to identify the main factors influencing the psychological fear of recurrence in CP patients. A *P*-value of less than 0.05 was considered statistically significant.

Results

General information

Among the 152 samples, 63.2% (n=96) were female, and 36.8% (n=56) were male, as depicted in **Figure 1**. The age of participants ranged from 9 to 69 years, with a median age of 18 years (interquartile range: 14-46 years). Regarding education level, 7.2% (n=11) had completed only primary school, 13.8% (n=21) had middle school education, 32.9% (n=50) had high school education, and 46.1% (n=70) had undergraduate college education. Tumor size ranged from 1 cm to 3.4 cm, with a mean size of 2.45±0.64 cm. Of the participants, 65.1% (n=99) underwent GTR, while 34.9% (n=53) underwent STR. The tumor type was adamantinomatous in 67.1% (n=102) and squamous papillary in 32.9% (n=50). As for payment source, 58.6% (n=89) were covered by medical insurance, 18.4% (n=28) were self-payment, and 23% (n=35) were paid by other means.

Psychological fear of recurrence, anxiety and depression, social support, and simplified coping scores in postoperative CP patients.

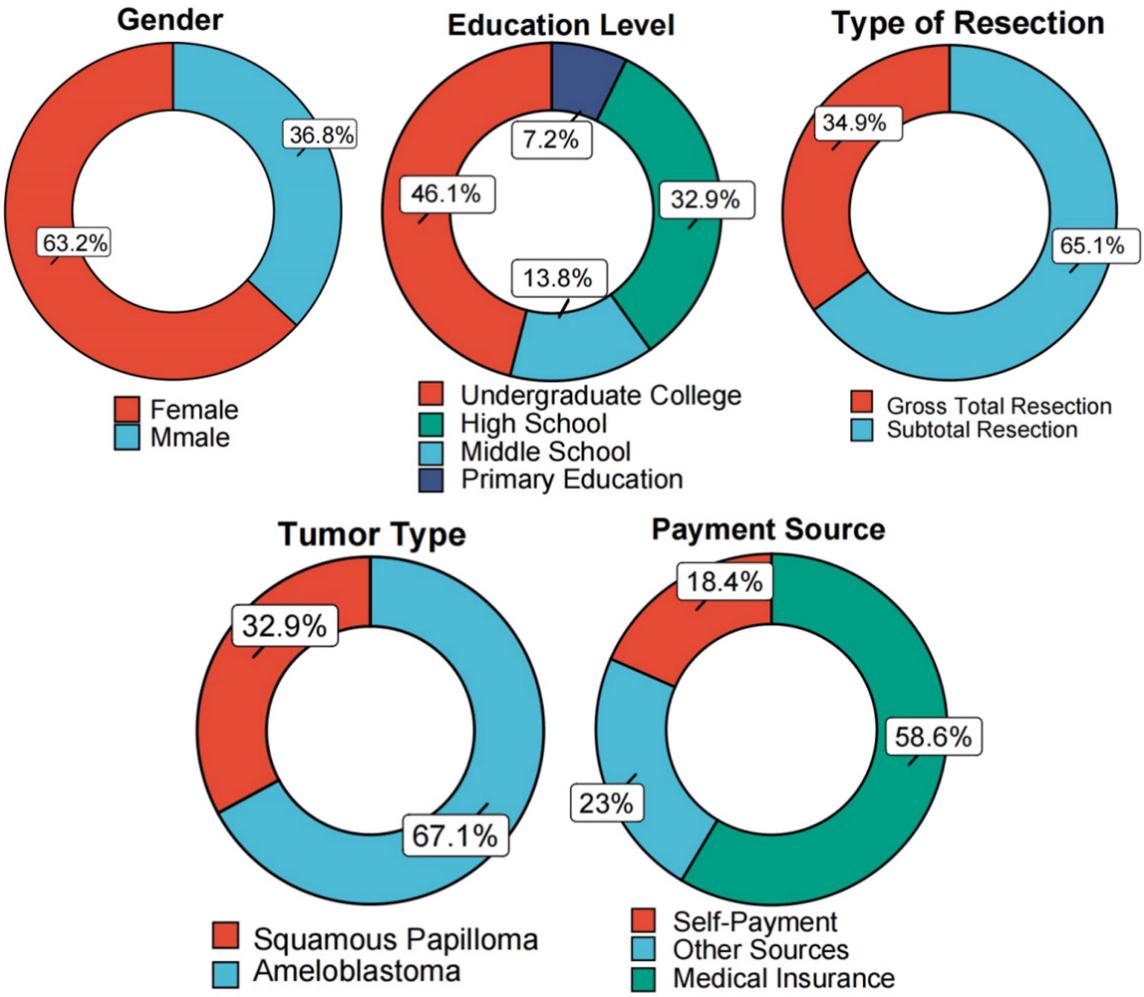

Figure 1. Demographic and clinical characteristics of the included patients.

Table 1. Scores of FOP-Q-SF, HADS anxiety and depression, social support, positive coping, and negative coping in PC patients with craniopharyngioma

Variable	Mean	SD	Individuals scoring ≥ threshold, n (%)
FoP-Q-SF	36.29	5.22	108 (71.1)
HADS anxiety	6.55	2.68	46 (30.3)
HADS depression	6.90	1.74	54 (35.5)
Social support	35.22	12.19	-
-Objective support	8.63	4.63	-
-Subjective support	18.95	5.41	-
-Utilization of support	7.72	2.74	-
Positive coping	17.78	5.06	-
Negative coping	18.99	4.58	-

SD: standard deviation; PC: craniopharyngioma; FoP-Q-SF: Fear of Progression Questionnaire-Short Form; HADS: Hospital anxiety and depression scale. The threshold score for FOP-Q-SF is 34, while the threshold for HADS scale is 8.

In this study, postoperative FoP-Q-SF total score for CP patients was (36.29±5.22) (**Table 1**), with 108 cases (71.1%) scoring ≥34. The HADS-anxiety score was 6.54±2.68, with 46 individuals (30.3%) scoring ≥8; the HADS-depression score was 6.90±1.74, with 54 individuals (35.5%) scoring ≥8. Social support score was 35.22±12.19, including objective support (8.63±4.63), subjective support (18.95±5.41), and utilization support (7.72±2.74). A positive coping score was 17.78±5.06, while negative coping score was 18.99±4.58.

Univariate analysis

Descriptive statistics and demographic data are presented in **Tables 2**, **3**.

Table 2. Comparison of fear of recurrence and HADS scores across PC patients with different demographic characteristics

Items		N (%)	FoP-Q-SF	t/F	P	HADS-anxiety	t/F	P	HADS-depression	t/F	P
Gender	Female	96 (63.2)	34.72±5.95	-6.690	<0.001	7.23±1.93	3.822	<0.001	6.67±1.78	-2.199	0.029
	Male	56 (36.8)	38.98±1.45			5.38±3.32			7.30±1.63		
Age	<50 years old	121 (79.6)	36.41±5.22	0.576	0.566	6.38±2.88	-2.169	0.033	6.64±1.65	-3.735	<0.001
	≥50 years old	31 (20.4)	35.80±5.29			7.19±1.49			7.90±1.76		
Education level	Primary school	11 (7.2)	36.55±5.75	0.137	0.938	7.09±3.14	0.373	0.772	7.27±1.56	1.252	0.293
	Middle school	21 (13.8)	36.67±4.12			6.62±1.53			7.00±2.21		
	High school	50 (32.9)	36.48±4.95			6.26±2.76			7.18±1.34		
	Undergraduate college	70 (46.1)	36.0±5.70			6.64±2.83			6.61±1.86		
Tumor size	<2.4 cm	67 (44.1)	31.84±3.30	-14.294	<0.001	6.69±0.61	0.642	0.523	6.27±1.59	-4.181	<0.001
	≥2.4 cm	85 (55.9)	39.80±3.49			6.44±3.54			7.40±1.71		
Type of resection	STR	99 (65.1)	38.66±4.45	9.711	<0.001	6.47±3.29	-0.598	0.551	7.27±1.62	3.738	<0.001
	GTR	53 (34.9)	31.87±3.36			6.68±0.64			6.21±1.78		
Tumor type	Adamantinomatous	102 (67.1)	36.53±5.26	0.808	0.420	6.40±3.08	-1.165	0.246	6.69±1.66	-2.198	0.029
	Squamous papillary	50 (32.9)	35.8±5.17			6.84±1.56			7.34±1.85		
Payment source	Medical insurance	89 (58.6)	36.56±5.20	1.780	0.172	6.48±2.69	0.910	0.405	6.92±1.54	0.016	0.984
	Self-expense	28 (18.4)	34.64±4.29			6.14±2.05			6.86±2.12		
	Other	35 (23.0)	36.91±5.813			7.03±3.06			6.89±1.95		

GTR: gross total resection; STR: subtotal resection; FoP-Q-SF: Fear of Progression Questionnaire-Short Form; PC: craniopharyngioma; HADS: Hospital anxiety and depression scale.

Table 3. Comparison of social support, positive coping and negative coping across PC patients with different demographic characteristics

Items		SSRS	t/F	P	Positive coping	t/F	P	Negative coping	t/F	P
Gender	Female	39.17±13.34	7.002	<0.001	19.41±5.26	6.432	<0.001	17.16±4.74	-9.318	<0.001
	Male	28.46±5.20			15.00±3.19			22.12±1.67		
Age	<50 years old	35.71±12.38	0.973	0.332	17.65±5.11	-0.624	0.534	18.99±4.72	0.026	0.979
	≥50 years old	33.32±11.40			18.29±4.92			18.97±4.05		
Education level	Primary school	37.00±12.86	0.633	0.595	17.45±5.66	0.121	0.948	18.27±5.44	0.160	0.923
	Middle school	31.95±10.32			17.71±4.34			19.43±3.75		
	High school	35.40±11.63			17.52±5.16			18.90±4.51		
	Undergraduate college	35.80±13.05			18.04±5.20			19.03±4.79		
Tumor size	<2.4 cm	43.19±13.59	8.062	<0.001	21.58±3.27	11.003	<0.001	15.27±3.93	-12.159	<0.001
	≥2.4 cm	28.94±5.62			14.79±4.13			21.92±2.41		
Type of resection	STR	31.48±9.65	-5.151	<0.001	15.70±4.51	-8.384	<0.001	20.91±3.75	8.626	<0.001
	GTR	42.21±13.41			21.68±3.51			15.40±3.77		
Tumor type	Adamantinomatous	35.96±12.31	1.065	0.289	17.56±5.07	-0.778	0.438	19.09±4.70	0.389	0.698
	Squamous papillary	33.72±11.92			18.24±5.07			18.78±4.36		
Payment source	Medical insurance	34.47±11.86	0.788	0.457	17.26±5.22	2.876	0.059	18.88±4.75	1.359	0.260
	Self-expense	37.79±14.23			19.82±3.50			18.11±4.79		
	Other	35.09±11.34			17.49±5.42			19.97±3.85		

PC: craniopharyngioma; SSRS: social support rating scale; STR: subtotal resection; GTR: gross total resection.

Regarding FoP-Q-SF scores, significant differences were found in resection type, gender, and tumor size (P<0.001), with patients who underwent total resection, female patients, and those with tumors <2.4 cm having lower scores. Patients stratified by age, education level, pathological type, and payment source showed no significant differences in FoP-Q-SF scores.

Regarding emotional state measured by the HADS, gender and age emerged as key factors. Female patients demonstrated significantly higher anxiety scores than males (P<0.001), while patients over 50 years old showed consistently higher scores for both anxiety (P=0.033) and depression (P<0.001), suggesting that older patients may face greater emotional challenges. Tumor size also influenced depression scores, with patients having tumors smaller than 2.4 cm showing lower depression scores (P<0.001). Pathological type was another influencing factor, with squamous papillary lesions associated with higher depression scores (P=0.029). Additionally, patients who underwent GTR demonstrated lower depression scores (P<0.001). Neither education level nor payment source showed significant effects on HADS scores.

Female patients demonstrated significantly higher scores in social support and positive coping compared to their male counterparts, while also exhibiting significantly lower scores in negative coping (P<0.001). Additionally, patients with tumors smaller than 2.4 cm reported higher levels of social support (P< 0.001). Furthermore, those who underwent GTR scored higher in positive coping (P<0.001) and lower in negative coping (P<0.001).

Correlations between psychometric indicators

The FoP-Q-SF scores showed a positive yet insignificant correlation with HADS-anxiety (r= 0.109, P>0.05; **Figure 2**); However, a significant positive correlation was found with HADS-depression (r=0.468, P<0.001). The FoP-Q-SF scores were negatively correlated with SSRS (r=-0.753, P<0.001) and positive coping (r= -0.833, P<0.001), while showing a significant positive correlation with negative coping (r= 0.818, P<0.001). HADS-depression also demonstrated a significant negative correlation with SSRS (r=-0.508, P<0.001) and positive coping (r=-0.425, P<0.001), while showing a significant positive correlation with negative coping (r=0.468, P<0.001). SSRS was positively correlated with positive coping (r=0.690, P<0.001) and negatively correlated with negative coping (r=-0.777, P<0.001).

Multiple linear regression

Regression analysis was conducted to explore the impact of multiple factors (including HADS-depression scores, social support, positive and negative coping, gender, type of resection, and tumor size ≥2.4 cm) on the fear of recurrence, as well as the interaction effect between HADS-depression score and gender. The results (**Table 4**) showed that, after controlling for other factors, HADS-depression score (β=0.057, P>0.05) did not show a significant effect on its own. However, the interaction between HADS-depression score and gender (β=-0.451, P<0.01) was significant, indicating that gender may moderate the relationship between depression and fear of recurrence. In addition, social support (β=-0.072, P<0.001), positive coping (β=-0.363, P<0.001), and negative coping (β=0.304, P<0.001) all had significant effects on fear of recurrence. Gender (β=-2.592, P<0.001) and tumor size ≥2.4 cm (β=3.353, P<0.001) also showed significant main effects. The model showed good fit, with R^2 values of 0.856 (model without interaction term) and 0.860 (model with interaction term), and a low standard error of residuals, indicating that the selected variables could effectively explain the variation in fear of recurrence. Further analysis using R to plot the simple slopes of the interaction (**Figure 3**) showed that as HADS-depression scores increased, female FoP-Q-SF scores increased accordingly, while male FoP-Q-SF scores decreased slightly.

The indicators were standardized, and a forest plot of the importance of the indicators was drawn using the standardized coefficients in the regression model (**Figure 4**). In both the no interaction (**Figure 4A**) and interaction (**Figure 4B**) models, positive coping had the greatest negative impact on the fear of recurrence, followed by the significant negative impact of social support. The type of resection and tumor size also had a significant but opposite impact on fear of recurrence, with the for-

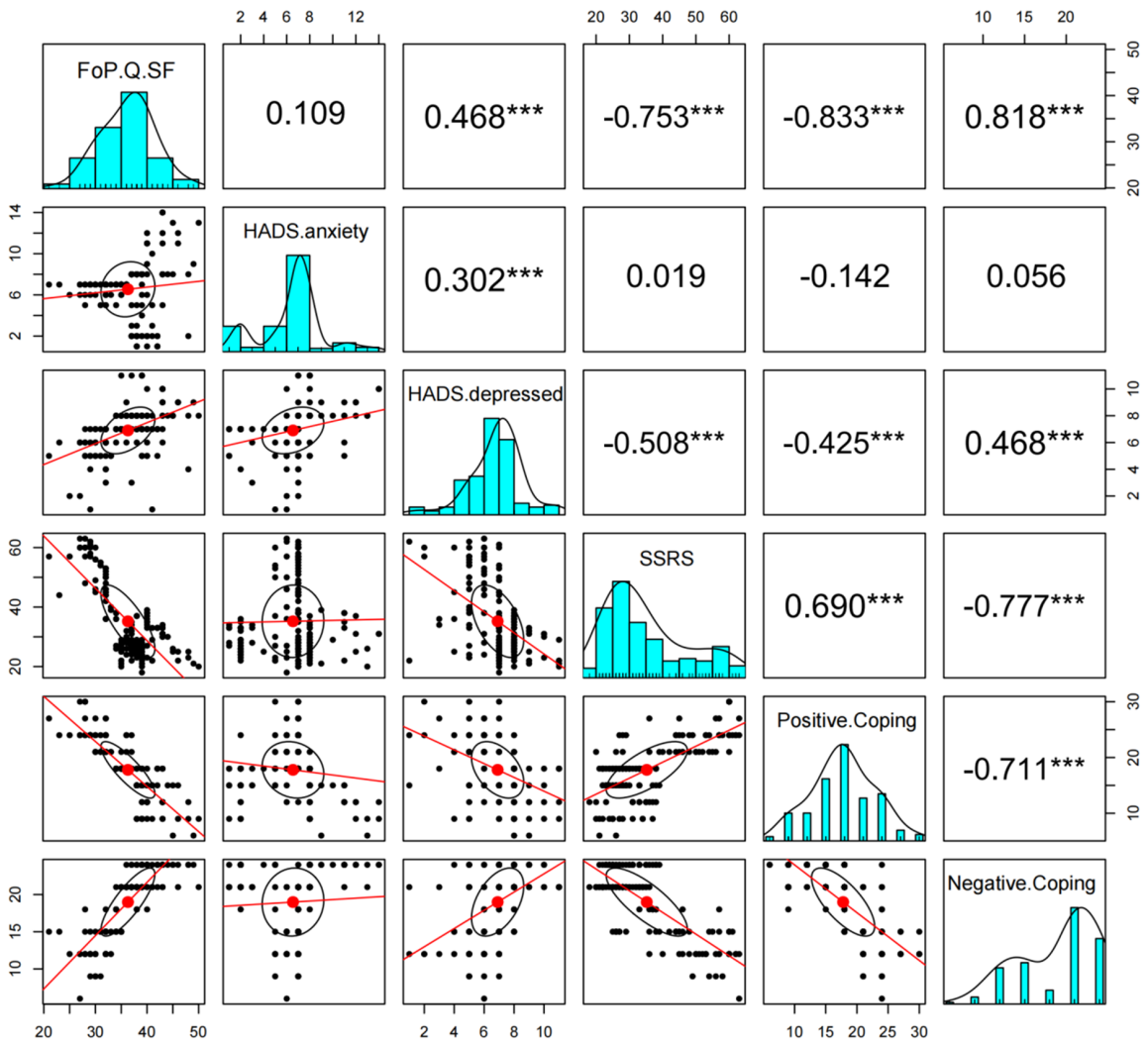

Figure 2. Correlations between fear of disease recurrence and HADS scores, SSRS, and coping styles. The figure depicts distributions and relationships among six measured variables, with correlation coefficients indicating the strength of linear relationships between variables. Scatter plots illustrate the correlations between each pair of variables. Histograms reveal the distribution of the variables. ***Correlation is significant at the level of 0.001; **Correlation is significant at the level of 0.01; *Correlation is significant at the level of 0.05. HADS: hospital anxiety and depression scale.

mer being negative and the latter positive. In the interaction model, the interaction between HADS-depression score and gender was more important than social support, while negative coping had a significant positive impact.

Discussion

Craniopharyngioma (CP) is a benign tumor with a high survival rate, but its proximity to important brain structures such as the hypothalamus, optic chiasm, and pituitary stalk makes surgery complex. The tumor and its treatment, including surgery and radiotherapy, can lead to hypothalamic damage, resulting in complications such as hypopituitarism, diabetes insipidus, and hypothalamic obesity [15, 16]. As a result, CP patients may experience psychological challenges like those of cancer patients, including fear of recurrence and concerns about their future health. In this study, a questionnaire survey of 152 patients revealed a significantly high incidence of fear of disease recurrence, as well as related anxiety and depression symptoms. Positive coping, negative coping, type of resection, and social support are the main factors influencing the fear of recurrence in CP patients.

Table 4. Multiple linear regression analysis of factors affecting fear of disease recurrence

Items	Main effects	Interaction
Constant	38.580 (2.301)***	37.277 (2.367)***
HADS - depression	0.057 (0.112)	0.256 (0.149)*
SSRS	-0.072 (0.024)***	-0.068 (0.023)***
Positive coping	-0.363 (0.053)***	-0.350 (0.053)***
Negative coping	0.304 (0.070)***	0.276 (0.070)***
Gender	-2.592 (0.477)***	0.779 (1.737)
Type of resection	-1.088 (0.514)**	-1.042 (0.509)**
Tumor size	3.353 (0.635)***	3.433 (0.629)***
HADS depression: gender	-	-0.451 (0.224)**
Observed cases	152	152
R^2	0.856	0.860
Adjusted R^2	0.849	0.852
Residual (Std. Error)	2.030 (df=144)	2.009 (df=143)
F Statistic	122.236 (df=7; 144)***	109.741 (df=8; 143)***

HADS: Hospital anxiety and depression scale; SSRS: social support rating scale. ***P<0.001, **P<0.01, *P<0.05.

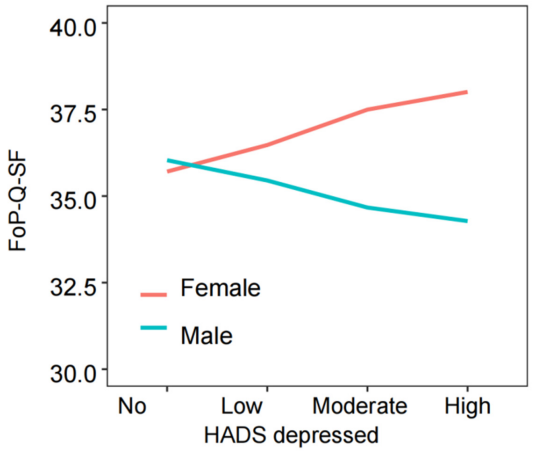

Figure 3. Simple slopes of the interaction between HADS depression and gender.

In the survey, patients reported FoP-Q-SF scores (36.29±5.22) comparable to those seen in patients with malignant tumors, with 71.1% scoring above the clinically significant threshold. This aligns with findings from Du et al. [17] on primary brain tumor patients, showing that even individuals with benign brain tumors experience substantial uncertainty and fear of recurrence. Fric et al. [7] also reported that while long-term overall and disease-specific survival rates for craniopharyngioma surgery are favorable (75% and 84%, respectively), partial resection and systemic complications are indeed associated with a poorer prognosis. This may explain why surgical resection type emerged as a significant factor influencing fear of recurrence in this study. Prieto et al. [18] conducted a systematic analysis of the largest series of papillary craniopharyngiomas (PCP) cases, revealing the associations between tumor location and hypothalamic dysfunction. PCP, often occurring in adult males, tends to be in the third ventricle. Tumor not strictly confined to the third ventricle are associated with a higher risk of hypothalamic adhesion and tumor recurrence. This is crucial, as it highlights additional challenges CP patients face postoperatively, especially those who have undergone subtotal resection, have systemic comorbidities, or experience hypothalamic dysfunction.

This study highlights the significant role of gender in moderating the relationship between depression and fear of recurrence in CP patients. When the interaction term between depression and gender was introduced, the independent effect of depression became insignificant, and the gender effect was also mitigated, indicating that the influence of depression on the FOP-Q-SF score is moderated by gender. Specifically, the data revealed that for female patients, fear of recurrence increased as depressive symptoms intensified, while for male patients, the opposite trend was observed, with fear of recurrence decreasing as depressive symptoms increased. The identification of this gender moderation effect advances our understanding of the psychological profile of CP patients, building on

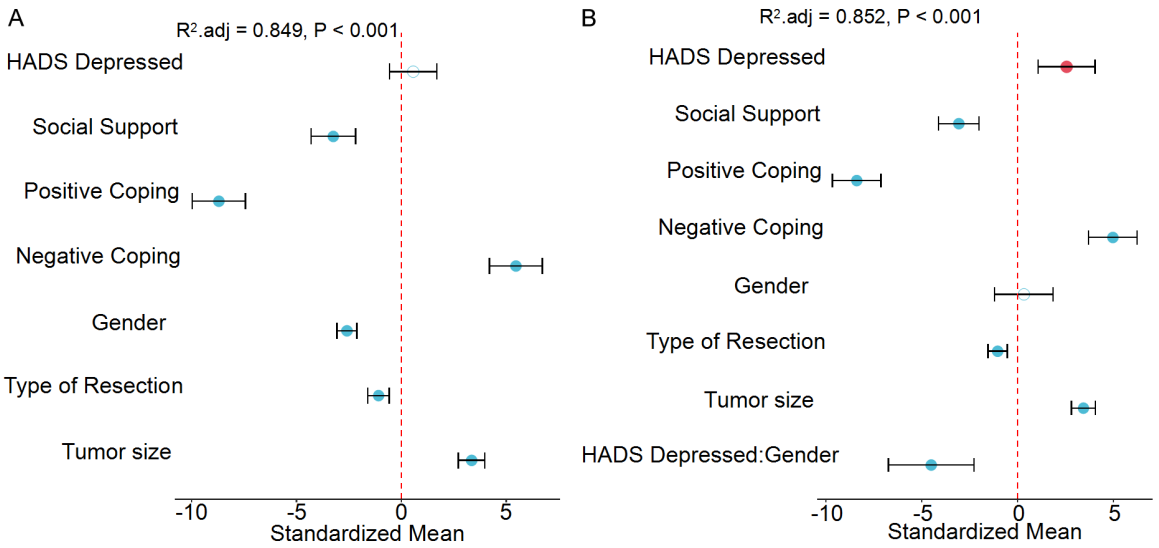

Figure 4. Standardized regression coefficients to assess the relative importance of variables. A: Model without interaction effects; B: Model with interaction effects. Blue solid circles indicate P<0.05, orange solid circles indicate P<0.1, and blue hollow circles indicate P>0.05.

insights from prior research. While earlier studies have highlighted the influence of gender on mental health among brain tumor patients, this study is the first to demonstrate how gender modulates the association between depression and fear of recurrence. This gender difference may be related to emotional regulation, coping strategies, and sociocultural factors, suggesting that clinical interventions should take gender differences into account to more specifically address patients' fear of recurrence.

Through multiple regression analysis, this study demonstrated that positive coping strategies served as the primary protective factor against fear of recurrence, while negative coping mechanisms significantly exacerbate it. These findings align with Du et al. [17], underscoring the crucial role of adaptive coping strategies in reducing patients' psychological burden. Furthermore, our analysis revealed a significant inverse relationship between social support and fear of recurrence, enhancing our understanding of how social support influence patient outcomes beyond what previous research has shown. This suggests that patients who employ more positive coping strategies, such as seeking social support and problem-solving, tend to have a lower fear of recurrence, whereas patients who use more negative coping strategies, such as avoidance and catastrophizing, have a higher fear of recurrence. Positive thinking is a key component of effective stress management and is associated with numerous health benefits, including better stress management, improved immune function, and a reduced risk of depression and anxiety. Positive coping strategies, sufficient social support, and addressing disease uncertainty are crucial for improving patients' psychological states, particularly in reducing depression and fear of disease recurrence [19].

The type of resection is another key factor affecting the fear of recurrence identified by this study. Specifically, patients who underwent subtotal resection reported higher levels of fear of recurrence, likely due to the incomplete removal of tumor tissue and the inherent risk of residual tumor growth. Subtotal resections are often performed when the tumor is located close to critical structures such as the hypothalamus, optic chiasm, or pituitary stalk, making total resection difficult without causing damage to these vital areas. As a result, patients with residual tumor tissue are at an increased risk of recurrence, which may amplify their psychological distress. This finding is consistent with prior research [18], which reported a close association between tumor location and recurrence risk. This study further demonstrates that this objective recurrence risk has a direct impact on patients' subjective

psychological state. Therefore, for patients undergoing subtotal resection, frequent imaging and clinical evaluations are required to detect recurrence or complications. However, it is important to note that even with complete resection, the risk of new lesions or postoperative complications can arise, which may still necessitate regular follow-up care. For patients with subtotal resection, since the tumor has not been completely removed, the risk of recurrence is relatively higher. These regular check-ups, while essential for early detection, can inadvertently increase patients' anxiety, as they may perceive the frequent visits as a reminder of the ongoing risk of recurrence. This reinforces the notion that while medical surveillance is necessary, it must be balanced with psychological support to manage the fear and anxiety associated with the uncertainty of disease recurrence.

In summary, the psychological state of CP patients requires special attention and support. These patients often face significant stress from the disease, including the fear of recurrence, side effects of treatment, and changes in daily life. Persistent psychological stress often leads to depression and anxiety, which not only affect their quality of life and may worsen therapeutic outcomes. For postoperative CP patients, nursing interventions should focus on regular psychological assessments to identify specific psychological needs, providing personalized psychological support and education to help patients manage their emotional responses, teaching positive coping skills like emotional regulation and stress management to address fear of recurrence, promoting social support networks through family and community resources, and ensuring coordinated care through multidisciplinary team collaboration. Additionally, continuous evaluation of the effectiveness of nursing interventions, with necessary adjustments based on patient feedback and progress, is essential to achieve optimal care outcomes.

Although our study provides valuable insight, it also has some limitations. First, our sample may not be large enough to represent all CP patient populations, and the study was limited to patients from a single medical center. Future research should include a broader sample, incorporating patients from different regions and cultural backgrounds. Moreover, long-term follow-up studies will help better understand the evolution of the psychological state of CP patients and the long-term effects of interventions. We look forward to performing such studies to validate our findings and provide more comprehensive support for CP patients.

Disclosure of conflict of interest

None.

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References

[1] Pang JC, Chung DD, Wang J, Abiri A, Lien BV, Himstead AS, Ovakimyan A, Kim MG, Hsu F and Kuan EC. Characteristics and outcomes in pediatric versus adult craniopharyngiomas: a systematic review and meta-analysis. Neurosurgery 2023; 92: 1112-1129.

[2] Park HJ, Dho YS, Kim JH, Kim JW, Park CK and Kim YH. Recurrence rate and prognostic factors for the adult craniopharyngiomas in long-term follow-up. World Neurosurg 2020; 133: e211-e217.

[3] Wu J, Wu X, Yang YQ, Ding H, Yang L, Bao YY, Zhou L, Yang CX and Hong T. Association of histological subtype with risk of recurrence in craniopharyngioma patients: a systematic review and meta-analysis. Neurosurg Rev 2022; 45: 139-150.

[4] Bergerot CD, Philip EJ, Bergerot PG, Siddiq N, Tinianov S and Lustberg M. Fear of cancer recurrence or progression: what is it and what can we do about it? Am Soc Clin Oncol Educ Book 2022; 42: 1-10.

[5] Bahlburg H, Reicherz A, Reike M, Bach P, Butea-Bocu MC, Tully KH, Roghmann F, Noldus J and Muller G. A prospective evaluation of quality of life, psychosocial distress, and functional outcomes two years after radical cystectomy and urinary diversion in 842 German bladder cancer patients. J Cancer Surviv 2024; [Epub ahead of print].

[6] Fehrenbach MK, Brock H, Mehnert-Theuerkauf A and Meixensberger J. Psychological distress in intracranial neoplasia: a comparison of patients with benign and malignant brain tumours. Front Psychol 2021; 12: 664235.

[7] Fric R, Konig M, Due-Tonnessen BJ, Ramm-Pettersen J and Berg-Johnsen J. Long-term outcome of patients treated for craniopharyngioma: a single center experience. Br J Neurosurg 2023: 1-9.
[8] Zukowska Z, Allan S, Eisner E, Ling L and Gumley A. Fear of relapse in schizophrenia: a mixed-methods systematic review. Soc Psychiatry Psychiatr Epidemiol 2022; 57: 1305-1318.
[9] Mehnert A, Herschbach P, Berg P, Henrich G and Koch U. Fear of progression in breast cancer patients--validation of the short form of the Fear of progression questionnaire (FoP-Q-SF). Z Psychosom Med Psychother 2006; 52: 274-288.
[10] Zhen J, Wang J, Wang YL, Jiao J, Li J, Du XJ and Li YL. Fear of recurrence in elderly patients with coronary heart disease: the current situation and influencing factors according to a questionnaire analysis. BMC Cardiovasc Disord 2022; 22: 419.
[11] Wu QY, Ye ZX, Li L and Liu PY. Reliability and validity of Chinese version of fear of progression questionnaire-short form for cancer patients. Chinese Journal of Nursing 2015; 50: 1515-1519.
[12] Zigmond AS and Snaith RP. The hospital anxiety and depression scale. Acta Psychiatr Scand 1983; 67: 361-370.
[13] Xiao SY. Theoretical foundations and research applications of the social support rating scale (SSRS). J Clin Psychiatry 1994: 98-100.
[14] Xie YN. A preliminary study of the reliability and validity of the simplified coping style questionnaire. Chinese Journal of Clinical Psychology 1998: 114-115.
[15] Pascual JM, Prieto R and Rosdolsky M. Craniopharyngiomas primarily affecting the hypothalamus. Handb Clin Neurol 2021; 181: 75-115.
[16] Castle-Kirszbaum M, Shi M and Goldschlager T. Quality of life in craniopharyngioma: a systematic review. World Neurosurg 2022; 164: 424-435.
[17] Du L, Cai J, Yu J, Chen X, Yang X, Xu X and Zhang X. Relations between posttraumatic growth and fear of progression among young and middle-aged primary brain tumor patients: the parallel mediating role of perceived social support and Illness uncertainty. World Neurosurg 2024; 184: e794-e802.
[18] Prieto R, Barrios L and Pascual JM. Papillary craniopharyngioma: a type of tumor primarily impairing the hypothalamus - a comprehensive anatomo-clinical characterization of 350 well-described cases. Neuroendocrinology 2022; 112: 941-965.
[19] Boselie J and Peters ML. Shifting the perspective: how positive thinking can help diminish the negative effects of pain. Scand J Pain 2023; 23: 452-463.