



Full Length Article

Psychological distress and quality of life in Chinese early-stage breast cancer patients throughout chemotherapy

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ABSTRACT

Background: Breast cancer survivors with psychological problems have higher mortality than those without. Therefore, it is important to monitor and manage their psychological status. This study mainly aimed to dynamically estimate the prevalence of anxiety and depression and to clarify the factors associated with anxiety and depression of patients undergoing adjuvant chemotherapy. The secondary objective was to investigate the relationship between depression and anxiety and quality of life (QOL) in Chinese early-stage breast cancer patients.

Methods: In a prospective observational single-center cohort study with early-stage breast cancer patients ($n = 290$), depression and anxiety severity, QOL, and social support were measured using the Hospital Anxiety and Depression Scale (HADS), the Functional Assessment of Cancer Therapy-Breast Cancer (FACT-B) scale, and the Chinese version of the Social Support Rating Scale (SSRS), respectively. Canonical correlations were applied to identify correlates between anxiety and depression and demographic and clinical variables. One-way repeated measure analysis of covariance (RMANCOVA) was used to analyze dynamic changes in anxiety, depression, and QOL. Relationships between anxiety and depression and QOL were analyzed using two-way RMANCOVA.

Results: The overall anxiety and depression prevalence rates were 35.2% and 44.1%, respectively. Age ($P = 0.042$), surgical method ($P = 0.009$), social support ($P = 0.001$), and breast cancer family history ($P = 0.045$) were significantly associated with depression. The number of children ($P = 0.048$) was significantly associated with anxiety. FACT-B scores differed between anxiety and depression and nonanxiety and depression groups, and patients with higher HADS depression and anxiety scores had lower FACT-B scores during chemotherapy ($P < 0.001$).

Conclusions: We observed dynamic changes in anxiety and depression and QOL and associated factors of anxiety and depression. These findings can provide guidance for psychological monitoring and support for breast cancer patients during the postoperative chemotherapy period.

1. Introduction

Breast cancer is the most common cancer in women, with an estimated 2.3 million new cases worldwide in 2020.¹ The incidence of breast cancer in China is increasing year by year, with 304,000 women diagnosed with breast cancer in 2016.² With advances in diagnosis and treatment, the 5-year survival rate of early-stage breast cancer has been continuously improving. The 5-year survival rate for breast cancer in China ranges from 80% to 84% according to data released by the National Cancer Center in 2015.³ Adverse events related to antitumor therapy and comorbidities have gradually emerged, thereby affecting the

survival and prognosis of patients.⁴ Among them, psychological distresses are common encountered with breast cancer survivors, resulting in a decrease in mental and physical quality of life (QOL).⁵ Psychological distress is a multifactorial unpleasant experience of psychology (i.e., anxiety, depression, and cognitive) that may interfere with one's ability to cope effectively with cancer, its physical symptoms, and its treatment.⁶

Several studies have shown that the most common psychological problems among breast cancer survivors are depression and anxiety.^{7,8} Approximately, 30%-40% of breast cancer patients suffer from anxiety and depression.^{9,10} A considerable amount of literature has published

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that sociodemographic factors such as age, socioeconomic status, marital status, and cancer-related treatment are associated with depression and anxiety, and higher levels of depression and anxiety are negatively associated with perceived social support.^{11–13} Researchers recognize that depression and anxiety may affect physiological functions and compliance with cancer treatment.¹⁴ QOL reflects the impact of a patient's breast cancer diagnosis and treatment on daily life through subjective assessments of physical, mental, and social well-being.¹⁵ Breast cancer patients with depression have lower QOL and higher mortality than nondepressed patients.^{16–18} Adjuvant chemotherapy is recommended as a treatment for patients with a high risk of early breast cancer recurrence. However, adverse events may likely occur during the course of adjuvant chemotherapy, such as gastrointestinal adverse events, alopecia, and myelosuppression, which may affect the QOL and psychological health status of breast cancer patients.¹⁹

However, far too little attention has been given to the factors related to dynamic changes in the psychological status of Chinese breast cancer patients over the course of adjuvant chemotherapy. The main purpose of this study was to examine the prevalence and dynamic changes in anxiety and depression during postoperative adjuvant chemotherapy in Chinese breast cancer patients and to clarify the factors associated with anxiety and depression, so as to strengthen psychological monitoring of high-risk populations and take preventive measures. The secondary objective was to investigate the impact of depression and anxiety on QOL and the importance of social support in patients during chemotherapy.

2. Materials and methods

2.1. Research design and study population

Patient eligibility criteria included the following: 1) age from 18 to 75 years; 2) diagnosed with stage I–III breast cancer; 3) had undergone surgery for breast cancer; 4) planned to receive recommended postoperative adjuvant chemotherapy; and 5) voluntarily provided written informed consent. We excluded patients who (a) were already receiving neoadjuvant chemotherapy before surgery; (b) had metastatic disease at diagnosis; (c) had difficulty understanding the questionnaire or communicating in Chinese; or (d) had significant psychiatric or other comorbid disease prohibiting participation.

2.2. Sociodemographic and clinical characteristics

The participants completed a demographic questionnaire that collected information on age, marital status, income, education level, and family history of cancer. The cancer stage, type of surgery received, and cancer therapy were acquired from the baseline medical records of the patients.

Depression and anxiety severity were measured using the Hospital Anxiety and Depression Scale (HADS), which has been validated in the breast cancer setting.^{20,21} Li et al. had confirmed the Chinese version of the HADS is a reliable and valid measure of anxiety and depression.²² The HADS is a 14-item symptom rating scale that assesses anxiety and depressive symptoms among individuals with cancer.²⁰ It is divided into an anxiety subscale (HADS-A) and a depression subscale (HADS-D). Each item is scored on a 4-point scale from 0 (not at all) to 3 (very much) such that total scores on each subscale can range from 0 to 21. The HADS-A and HADS-D subscales are most commonly used to identify clinically significant depression with cutoff scores of 8,²² and higher total and subscale scores indicated higher levels of distress. The average sensitivity and specificity of each subscale are 0.800.^{20,23}

Social support was measured by the Chinese version of the Social Support Rating Scale (SSRS), which was developed by Xiao Shuiyuan in 1994. The SSRS is a 10-item self-administered multidimensional questionnaire of social support frequently used with patients and consists of three subscales: objective support (4 items), subjective support (3 items), and social support utilization (3 items). The total score can range

from 12 to 66 points; scores of ≤ 33 points indicate poor social support, 33–45 points indicate good social support, ≥ 45 points indicate excellent social support, and higher scores indicate higher social support for patients.²⁴

The Chinese version of Functional Assessment of Cancer Therapy–Breast Cancer (FACT-B) Version 4 is a valid, responsive, and reliable instrument evaluating QOL issues among Chinese individuals with breast cancer, including 37 items.²⁵ The FACT-B questionnaire evaluates several QOL domains: physical, social/family, emotional, functional well-being, and a breast cancer-specific (BCS) subscale. Each item is scored on a 5-point scale (0 = none, 4 = very much). The domain scores for physical, social/family, and functional well-being range from 0 to 28, the emotional domain scores range from 0 to 24 points, and the BCS subscale domain scores range from 0 to 40. The Functional Assessment of Cancer Therapy–General (FACT-G) score adds the scores of the four well-being domains, and the FACT-B score is calculated by adding the total scores of the FACT-G and BCS subscale.²⁶

All patients received the recommended chemotherapy regimen. They were asked to complete the questionnaires before chemotherapy, after 2 cycles of chemotherapy, and after the entire course of chemotherapy.

2.3. Statistical analysis

All statistical analyses were conducted by using IBM SPSS Statistics Version 22.0. We used descriptive statistics to analyze the demographic data and disease characteristics and anxiety and depression severity. We assessed differences in the demographic data and the disease characteristics or outcome variables of the patients with or without anxiety and depression by using *t* tests or χ^2 -tests. A logistic regression model was used to investigate potential risk factors for anxiety and depression. We used one-way repeated measures analysis of covariance (RMANCOVA) to analyze dynamic changes in anxiety/depression scores and QOL between baseline and follow-up. The interaction of anxiety and depression and QOL was analyzed using two-way RMANCOVA. *P* < 0.05 was considered significant.

3. Results

3.1. Sociodemographic and clinical characteristics

Of the 300 patients approached regarding participation, all signed informed consent forms and returned the questionnaires before chemotherapy. Of those 300 patients, 4 patients were not recruited after 2 cycles of chemotherapy, and 6 patients did not complete the questionnaires after finishing the entire course of chemotherapy, resulting in a study population of 290 patients.

The mean [standard deviation (SD)] age of the patients was 47.1 (9.4) years. Among the 290 patients, 96.2% were married, 94.8% were living with others, and 94.5% had one or more children. Almost one-third of the patients (33.5%) were college or above graduates, 45.2% had moderate socioeconomic status, and the majority of patients (98.3%) had medical insurance. Most participants (72.1%) received mastectomy, approximately half of them (51.0%) were diagnosed with stage II disease, and 59.3% of the patients received anthracycline chemotherapy. A total of 31.4% of the patients had a family history of breast cancer, and 60.3% of patients had good social support (Table 1).

Throughout the entire course of chemotherapy, the prevalence of anxiety and depression was 35.2% and 44.1%, respectively. Of the 199 patients who had not been detected with anxiety before chemotherapy, 37 (18.6%) developed anxiety during chemotherapy, while 44 (19.0%) patients developed depression during chemotherapy among 232 patients who had not been detected with depression before chemotherapy. The severity of anxiety symptoms was highest before chemotherapy (mean = 6.0, SD = 3.6), decreased after 2 cycles of chemotherapy (mean = 5.7, SD = 3.5), and slightly increased after finishing chemotherapy (mean = 5.8, SD = 3.6). The dynamic changes of anxiety scores were

Table 1
Demographic and clinical characteristics of the patients ($n = 290$).

Variable	N (%)
Age, years	
Mean (SD)	47.1 (9.4)
Range	25–70
Age	
< 40	74 (25.5)
40–49	98 (33.8)
50–59	92 (31.7)
≥ 60	26 (9.0)
Marital status	
Single/Divorced/Widowed	11 (3.8)
Married	279 (96.2)
Educational status	
High school or lower	183 (63.1)
College or above	97 (33.5)
Unknown	10 (3.5)
Income (yuan/month/capita)	
< 5000	138 (47.6)
5000–9999	132 (45.5)
≥ 10000	12 (4.1)
Unknown	8 (2.8)
Cohabitation status	
Living alone	15 (5.2)
Living with others	275 (94.8)
Insurance	
Yes	285 (98.3)
No	4 (1.4)
Unknown	1 (0.3)
Number of children	
No child	16 (5.5)
One or more children	274 (94.5)
Family history of breast cancer	
Yes	91 (31.4)
No	199 (68.6)
Surgical method	
Mastectomy	209 (72.1)
Breast conserving	81 (27.9)
TNM stage	
I	76 (26.2)
II	148 (51.0)
III	66 (22.8)
Received anthracycline chemotherapy	
Yes	172 (59.3)
No	118 (40.7)
Social support before chemotherapy	
Poor	6 (2.1)
Moderate	109 (37.6)
Well	175 (60.3)

not statistically significant ($P = 0.208$) (Table 2). Using a cutoff score of HADS-A ≥ 8 , 31.4% of the patients had an increased risk for an anxiety disorder before chemotherapy, which decreased to 29.0% after 2 cycles of chemotherapy and slightly increased to 29.3% after the completion of chemotherapy. The mean score for depressive symptoms was 4.6 (SD = 3.6) before chemotherapy and increased to 5.1 after 2 cycles of chemotherapy. Thereafter, the mean score decreased after finishing chemotherapy (mean = 4.9, SD = 3.6) (Table 2). Before chemotherapy, 20.0% of patients had an increased risk of depression, which shifted to 25.2% and 24.8% after 2 cycles and the entire course of chemotherapy, respectively. The dynamic changes in depression scores were statistically significant as chemotherapy progressed ($P = 0.020$). Cronbach's alpha coefficients of the HADS scale scores ranged from 0.883 to 0.890.

3.2. Factors associated with depression and anxiety

We explored depression that occurred at least once during the entire course of chemotherapy and anxiety that occurred at least once during the entire course of chemotherapy. The results in Table 3 showed the impact of sociodemographic and clinical variables on anxiety and depression. Cronbach's alpha coefficients for the SSRS scales were 0.637,

0.803, and 0.743, respectively. Patients with poor social support were more depressed than those with good social support ($P = 0.003$). Patients who received breast-conserving surgery were less depressed than patients who received mastectomy ($P = 0.009$). Perimenopausal women and patients without a family history of tumors had a higher prevalence of depression ($P = 0.019$ and $P = 0.034$, respectively).

Multivariable analysis was used to predict the factors associated with depression. The results of the correlational analysis are presented in Table 4. In multivariate analysis, adjusted for the age, educational status, number of children, family history of breast cancer, surgical method, received anthracycline chemotherapy, and social support before chemotherapy; we found that age ($P = 0.042$), surgical method ($P = 0.009$), social support ($P = 0.001$), and family history of breast cancer ($P = 0.045$) were significantly associated with depression. We found that the number of children ($P = 0.048$) was significantly associated with anxiety after adjusting for the number of children, surgical method, and social support before chemotherapy into the multivariate logistic regression model (Table 5).

3.3. Dynamic changes in QOL scores

The mean, SD, and alpha coefficient of the domain, FACT-G, and FACT-B scores at baseline, after 2 cycles of chemotherapy and after the entire course of chemotherapy are shown in Table 6. The social well-being, BCS, and FACT-B scores were highest at baseline, then decreased with time, and were significantly lower after 2 cycles of chemotherapy and after the entire chemotherapy period than at baseline. The FACT-G scores after 2 cycles of chemotherapy were significantly lower than those at baseline. The physical well-being, emotional well-being, and functional well-being scores did not significantly change.

Next, we studied the differences in the dynamic changes in QOL between patients with and without anxiety and depression during chemotherapy. As shown in Table 7 and Table 8, the results indicated that patients with higher HADS depression or anxiety scores had lower FACT-B scores during chemotherapy. There were differences in FACT-B scores between the groups with and without anxiety and depression ($P < 0.001$). The scores in the without anxiety or depression group were always significantly higher than those in the anxiety and depression group. With the progression of chemotherapy, FACT-B scores in the anxiety and depression group were the lowest after 2 cycles of chemotherapy and increased slightly after the end of chemotherapy. FACT-B scores in the without anxiety and depression group showed a gradual downward trend, but these changes were not statistically significant ($P > 0.05$).

4. Discussion

Cancer patients are most likely to encounter psychological problems such as depression and anxiety. The prevalence of depression and anxiety has been reported to range from 10.0% to 42.0% in breast cancer patients^{9,27} and may even affect the survival and prognosis of patients,²⁸ which was significantly higher than that of adults.²⁹ The prevalence of depression among breast cancer survivors varies greatly across different populations, as researchers found that in some European and American countries, the proportion of patients with depression and anxiety varied from 35.0% to 45.0%. In this study, the prevalence of anxiety and depression were 35.2% and 44.1%, respectively, throughout the entire course of chemotherapy, which were comparable to the rates reported in previous studies.¹¹

We also observed dynamic changes in depression and anxiety in breast cancer patients during chemotherapy. Some previous studies on the psychological problems of breast cancer patients have mostly been cross-sectional studies,^{5,8,11,15} and there were few studies that provided a dynamic analysis of psychological problems of postsurgical breast cancer patients during chemotherapy. Our study dynamically monitored anxiety and depression symptoms before and during chemotherapy.

Table 2
Anxiety and depression in breast cancer patients.

Time	Anxiety		Depression	
	Mean (SD)	Number (%)	Mean (SD)	Number (%)
Before chemotherapy	6.0 (3.6)	91 (31.4)	4.6 (3.6)	58 (20.0)
After 2 cycles of chemotherapy	5.7 (3.5)	84 (29.0)	5.1 (3.8)	73 (25.2)
After completion of chemotherapy	5.8 (3.6)	85 (29.3)	4.9 (3.6)	72 (24.8)

Table 3
Univariate analysis of anxiety or depression and sociodemographic and clinical variables.

Variable	Depression		P	Anxiety		P
	No	Yes		No	Yes	
Age			0.019			0.430
< 40	54	20		42	32	
40–49	60	38		55	43	
50–59	52	40		47	45	
≥ 60	22	4		18	8	
Marital status			0.974			0.826
Single/Divorced/Widowed	7	4		7	4	
Married	181	98		155	124	
Educational status			0.081			0.922
High school or lower	113	70		103	80	
College or above	70	27		54	43	
Income (yuan/month/capita)			0.452			0.843
< 5000	86	52		80	58	
5000–9999	91	41		72	60	
≥ 10000	9	3		7	5	
Cohabitation status			0.338			0.740
Living alone	8	7		9	6	
Living with others	180	95		153	122	
Insurance			0.616			0.325
Yes	185	100		160	125	
No	2	2		1	3	
Number of children			0.051			0.035
No child	14	2		13	3	
One or more children	174	100		149	125	
Family history of breast cancer			0.034			0.581
Yes	67	24		53	38	
No	121	78		109	90	
Surgical method			0.009			0.100
Mastectomy	145	64		123	86	
Breast conserving	43	38		42	39	
TNM stage			0.938			0.715
I	49	27		40	36	
II	95	53		86	62	
III	44	22		36	30	
Received anthracycline chemotherapy			0.168			0.458
Yes	82	36		93	79	
No	106	66		69	49	
Social support before chemotherapy			0.003			0.073
Poor	2	4		3	3	
Moderate	60	49		52	57	
Well	126	49		107	68	

With the progression through chemotherapy, the detected rate of patients with anxiety status dropped from 31.4% to 29.0% after 2 cycles of chemotherapy and slightly increased to 29.3% after the entire chemotherapy course. Mean HAD-A scores also dropped after 2 cycles of chemotherapy, from 6.0 to 5.7 points, and then increased to 5.8 after chemotherapy completion. However, the prevalence of depression and HAD-D scores increased in this population, with the prevalence increasing from 20.0% to 25.2% and 24.8%, respectively; HAD-D scores increased from 4.6 to 5.2 points after 2 cycles of chemotherapy and subsequently decreased to 4.8 points after the completion of the chemotherapy. This may be partly due to side effects of chemotherapy that may have aggravated depressive symptoms in these patients. In addition, the changes in physical appearance, such as alopecia caused by chemotherapy, may have weakened their confidence and aggravated depression.⁵

These results indicated that patients have the highest prevalence of anxiety and the most severe anxiety before chemotherapy and the highest prevalence of depression and the most severe depression in the middle of chemotherapy. Through the analysis of the changes of depression in breast cancer patients during chemotherapy, doctors can give different degrees of psychological care and help patients in different periods of chemotherapy.

Previous studies on the relationship between sociodemographic and clinical characteristics and depression and anxiety have not been completely consistent. In our univariate analyses, we found that age, social support, family history of tumor, and surgical methods were related to depression throughout the course of chemotherapy. Previous research reported that younger age (< 50 years) was associated with depression.¹¹ Inconsistent with the findings of Soufiane Berhili, we found

Table 4
Multivariable analysis between depression and variables.

Variable	Depression			
	OR	95% CI-	95% CI+	P
Age				0.042
< 40	1.000			
40–49	1.843	0.908	3.738	
50–59	1.991	0.977	4.058	
≥ 60	0.508	0.147	1.749	
Family history of breast cancer				0.045
Yes	1.000			
No	1.840	1.014	3.337	
Surgical method				0.009
Mastectomy	1.000			
Breast conserving	2.152	1.210	3.828	
Social support				0.001
Poor	1.000			
Moderate	0.412	0.063	2.675	
Well	0.186	0.029	1.198	

Table 5
Multivariable analysis between anxiety and variables.

Variable	Anxiety			
	OR	95% CI-	95% CI+	P
Number of children				0.048
No child	1.000			
One or more children	3.635	1.013	13.045	

that patients aged 40–59 years were more likely to have depression than those aged less than 40 or more than 60 years. Moreover, patients with inadequate social and family support were situations in which a higher incidence of depression was encountered. This is consistent with the major factors associated with depression status of breast cancer patients described in the literature. Identical conclusions were obtained in studies where it was shown that adequate family support could have a positive impact on reducing depression in cancer patients. Patients lacking social family support were more likely to have psychological disorders such as anxiety and depression.^{11,30,31} In our study, patients without a family history of tumors and those who received breast-conserving surgery were more likely to develop depression than patients who had a family history or those who received mastectomy. It may be that patients without a family history have less knowledge about breast cancer, which results in poor psychological endurance. Furthermore, patients undergoing breast-conserving surgery may be more worried about relapse and have a heavier psychological burden. Some research has reported

that individuals with low income^{12,13} or low educational level,^{32,33} and those living alone¹³ have relatively high rates of depression. Nevertheless, in our study, other factors, such as educational status, cohabitation status, and income, were not statistically significant. Our findings, in line with previous studies, suggest that routine depression screening for breast cancer patients aged 40–59, having poor social support, being without a family history of tumors, and receiving breast-conserving surgery are of great importance. Previous studies have found anxiety was related to the presence of dependent children in adult advanced cancer patients,³⁴ and patients with dependent children had higher rates of anxiety compared to those without children.³⁵ In our study, we also obtained similar results that the number of children is one of the risk factors of anxiety. Patients with breast cancer who have more than one child are more likely to have anxiety than patients without children.

QOL refers to the impact of tumors and treatments on patients' lives and reflects the consequences of cancer treatment. Our study also dynamically monitored QOL of patients during chemotherapy. Anxiety and depression were significantly correlated with dynamic changes in QOL, and patients with severe depression and anxiety had poor QOL. Among people with depression and anxiety, QOL gradually decreased after the beginning of chemotherapy and reached the lowest point after 2 cycles of chemotherapy, which might have been due to this population having poor tolerance to chemotherapy. These findings suggest that in general, depression is related to QOL. There are similarities between the results in this study and those described by So WK,⁵ Bardwell,³⁶ and other researchers,^{12,13,37} in which the QOL was closely related to the prevalence of depressive symptoms in patients with early breast cancer.

The present study was a longitudinal study and successfully investigated changes in anxiety and depression and QOL in Chinese breast cancer patients over the course of adjuvant chemotherapy. We can conclude that patients are most likely to develop anxiety before chemotherapy, and patients are most likely to develop depression after 2 cycles of chemotherapy. In addition, this study elaborated on the relationship between depression, anxiety, and QOL. Among people with anxiety and depression, QOL was the lowest after 2 cycles of chemotherapy. This suggests the importance of psychological monitoring during chemotherapy for breast cancer patients such that clinicians can intervene for patients with psychological problems in a timely manner and improve their QOL.

Several limitations to this study need to be acknowledged. One of the limitations is that the patient samples in this study were all from one center, which limits generalizability. Next, this study is only an observational study, and there was no intervention. In future research, we need to pay more attention to psychological intervention to better understand the relationship between the prevention of psychological problems, QOL, and survival.

Table 6
Change of QOL score on the course of chemotherapy.

	Mean ^a	Alpha ^a	Mean ^b	Alpha ^b	Mean ^c	Alpha ^c	F	P	η ²
Quality of life assessment									
Physical well-being	21.6±4.9	0.815	21.3±5.0	0.834	21.3±5.1	0.852	0.926	0.397	0.003
Social well-being	22.5±6.6	0.908	21.4±6.9	0.924	21.6±6.5	0.899	7.735	0.001	0.025
Emotional well-being	18.2±4.1	0.699	18.5±3.8	0.660	18.4±3.9	0.661	1.003	0.364	0.003
Functional well-being	16.5±7.8	0.760	15.7±7.4	0.904	15.9±7.0	0.888	2.180	0.116	0.007
BCS	24.7±5.3	0.641	24.2±5.7	0.636	23.9±5.4	0.669	4.266	0.016	0.015
FACT-G	78.8±16.6	0.748	76.8±16.9	0.813	77.2±16.6	0.806	3.700	0.025	0.013
FACT-B	103.5±19.7	0.772	101.0±20.4	0.830	101.1±19.7	0.832	4.605	0.011	0.016

^a Before chemotherapy.^b After 2 cycles of chemotherapy.^c After completion of chemotherapy.

The difference between the mean at each time point and baseline was analyzed using one-way repeated measures analysis of covariance (RMANCOVA).

Abbreviations: BCS, breast cancer-specific. FACT-B, Functional Assessment of Cancer Therapy-Breast Cancer; FACT-G, Functional Assessment of Cancer Therapy-General; QOL, quality of life.

Table 7

Change of QOL score between patients with anxiety and nonanxiety.

	Anxiety (n = 128)			No anxiety (n = 162)			Group effect	Group & time interaction effect
	Mean (SD) ^a	Mean (SD) ^b	Mean (SD) ^c	Mean (SD) ^a	Mean (SD) ^b	Mean (SD) ^c	P	P
Quality of life assessment								
Physical well-being	19.6 (4.7)	18.8 (4.9)	19.1 (5.2)	23.3 (4.5)	23.2 (4.1)	23.1 (4.3)	0.000	0.347
Social well-being	22.5 (5.6)	20.6 (6.0)	20.6 (6.1)	22.5 (7.3)	21.9 (7.5)	22.4 (6.7)	0.549	0.004
Emotional well-being	16.3 (4.5)	16.5 (4.0)	16.7 (4.2)	19.7 (2.9)	20.0 (2.8)	19.8 (3.0)	0.000	0.595
Functional well-being	14.8 (7.79)	14.1 (6.7)	13.8 (6.8)	17.8 (7.7)	17.0 (7.7)	17.5 (6.8)	0.000	0.719
BCS	23.0 (5.8)	21.6 (5.5)	22.1 (5.7)	26.0 (4.5)	26.2 (5.0)	25.3 (4.6)	0.000	0.015
FACT-G	73.1 (16.3)	70.0 (15.9)	70.2 (16.7)	83.3 (15.4)	82.2 (15.8)	82.8 (14.2)	0.000	0.174
FACT-B	96.2 (20.1)	91.7 (19.2)	92.2 (20.4)	109.3 (17.5)	108.4 (18.2)	108.1 (16.0)	0.000	0.092

^a Before chemotherapy.^b After 2 cycles of chemotherapy.^c After completion of chemotherapy.

Dynamic changes of QOL and the effect on QOL over time between the anxiety and nonanxiety groups were analyzed using two-way repeated measures analysis of covariance (RMANCOVA) after adjusted for age and social support before chemotherapy.

Abbreviations: BCS, breast cancer-specific. FACT-B, Functional Assessment of Cancer Therapy-Breast Cancer; FACT-G, Functional Assessment of Cancer Therapy-General; QOL, quality of life.

Table 8

Change of QOL score between patients with depression and nondepression.

	Depression (n = 102)			No depression (n = 188)			Group effect	Group & time interaction effect
	Mean (SD) ^a	Mean (SD) ^b	Mean (SD) ^c	Mean (SD) ^a	Mean (SD) ^b	Mean (SD) ^c	P	P
Quality of life assessment								
Physical well-being	19.4 (5.0)	18.1 (5.1)	18.7 (5.4)	22.8 (4.5)	23.0 (4.0)	22.7 (4.4)	0.000	0.017
Social well-being	21.7 (5.9)	20.0 (6.3)	19.7 (6.2)	22.9 (6.9)	22.1 (7.1)	22.7 (6.4)	0.096	0.008
Emotional well-being	16.3 (4.3)	16.3 (4.0)	16.7 (4.1)	19.3 (3.5)	19.6 (3.2)	19.4 (3.4)	0.000	0.372
Functional well-being	13.9 (6.6)	13.3 (6.6)	13.3 (6.4)	17.9 (8.1)	17.0 (7.5)	17.2 (6.9)	0.000	0.857
BCS	23.4 (5.7)	21.8 (5.6)	22.0 (5.5)	25.4 (5.0)	25.5 (5.4)	24.9 (5.1)	0.000	0.022
FACT-G	71.3 (15.8)	67.8 (15.7)	68.4 (16.1)	82.8 (15.6)	81.7 (15.5)	82.0 (14.8)	0.000	0.154
FACT-B	94.7 (19.7)	89.6 (19.1)	90.4 (19.6)	108.3 (18.1)	107.2 (18.3)	106.9 (17.2)	0.000	0.050

^a Before chemotherapy.^b After 2 cycles of chemotherapy.^c After completion of chemotherapy.

Dynamic changes of QOL and the effect on QOL over time between the depression and nondepression groups were analyzed using two-way repeated measures analysis of covariance (RMANCOVA) after adjusted for age and social support before chemotherapy.

Abbreviations: BCS, breast cancer-specific. FACT-B, Functional Assessment of Cancer Therapy-Breast Cancer; FACT-G, Functional Assessment of Cancer Therapy-General; QOL, quality of life.

5. Conclusions

The main findings of this study were to examine the prevalence and dynamic changes in anxiety and depression in early-stage breast cancer patients undergoing postoperative adjuvant chemotherapy. Research disclosed that patients aged 40–59 years, having poor social support, not having a family history of tumors, and receiving breast-conserving surgery were more likely to develop depression. Oncologists and nurses should strengthen psychological monitoring in these high-risk groups and take preventive measures when necessary. Secondly, we found that psychological symptoms have a detrimental effect on QOL in patients and strong social support from the external environment and relatives will also improve the QOL of patients in treatment. This also provides important evidence for the overall management of patient treatment to improve QOL.

Declaration of competing interest

The authors declare that they have no conflict of interests.

Ethics statement

This study is a registered prospective observational single-center cohort study with 300 early-stage breast cancer patients. The ClinicalTrials.gov number is NCT05055375, and the study was conducted at the Medical Oncology Department at the National Cancer Center between

March 2019 and April 2021. It was conducted in compliance with the principles of the Declaration of Helsinki and approved by the Clinical Research Ethical Committee of the National Cancer Center/National Clinical Research Center for Cancer/Cancer Hospital in China (approval number: 19-013/1798). Written informed consent was obtained from all the participants.

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Data availability

The datasets are available from the corresponding author upon reasonable request.

Author contributions

F.M., B.L., and D.L. designed and conduct this study. F.M., B.L., and D.L. developed the methodology. B.L., D.L., M.Y., X.S., and L.Z. acquired and managed the data. F.M., B.L., and D.L. analyzed and interpreted the data. B.L., D.L., M.Y., X.S., and L.Z. wrote and revised the manuscript. F.M. supervised the study.

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