

# Dynamic change of depression and anxiety after chemotherapy among patients with ovarian cancer

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## Abstract

Psychological state of patients with ovarian cancer is worthy of attention. We aimed to investigate the levels of anxiety and depression in patients with ovarian cancer. We also investigated the dynamic changes in anxiety and depression levels after chemotherapy.

A total of 228 females were included in this study. Among them, a total of 111 participants had ovarian cancer and 117 females who underwent a physical examination were selected as healthy controls. All patients enrolled were asked to fill in the Self-rating Depression Scale and the Self-rating Anxiety Scale. For patients with ovarian cancer, repeat questionnaires were measured after cycle 1 chemotherapy.

The depression score of patients with ovarian cancer was  $45.90 \pm 10.19$ , significantly higher than in controls ( $36.08 \pm 9.06$ ,  $P < .001$ ). Similar results were observed in respect of anxiety score. The score of ovarian cancer patients was  $39.53 \pm 12.92$ , significantly higher than of controls ( $32.15 \pm 7.44$ ,  $P < .001$ ). Multivariate analyses were conducted, and the results showed that young age was the independent risk factor associated with depression among patients with ovarian cancer, while young age and singleness were the independent risk factors associated with anxiety. Repeat questionnaires were measured after chemotherapy. Interestingly, we found depression scores decreased from  $45.90 \pm 10.19$  to  $36.29 \pm 8.98$  after chemotherapy ( $P < .001$ ), while anxiety score increased from  $39.53 \pm 12.92$  to  $42.75 \pm 9.96$  after chemotherapy ( $P = .009$ ). Multivariate analysis suggested that only higher income and higher baseline depression score were the independent and most relevant risk factors associated with depression remission after chemotherapy. For patients with anxiety remission, only higher baseline anxiety score was the independent risk factor associated with anxiety remission.

This study suggests that for patients with ovarian cancer, timely monitoring of the patient's psychological state, especially before and after chemotherapy treatment, is very important. Assessing the changes in the patient's psychological state, screening the population with risk factors, and prompt intervention by mobilizing social support may be effective in preventing depression and anxiety in such population.

**Abbreviations:** SDS = Self-rating Depression Scale, SAS = Self-rating Anxiety Scale.

**Keywords:** anxiety, depression, ovarian cancer, psychological state, risk factor

## 1. Introduction

Ovarian cancer causes about 25,000 deaths in women in the United States and about 5000 women die from ovarian cancer each year in the United Kingdom.<sup>[1-3]</sup> More than 70% patients are diagnosed with extra-pelvic disease at advanced stage of the

ovarian cancer.<sup>[4,5]</sup> Standard chemotherapy agents for ovarian cancer include paclitaxel and platinum compounds, such as carboplatin. During the treatment of the disease, the patient's psychological state is worthy of attention. It is reported that up to 45% of cancer patients showed anxiety, and 25% of patients had depression.<sup>[4,5]</sup> In some small studies of ovarian cancer, clinical anxiety rate among patients was 22% to 29%, and clinical depression rate was reported as 17% to 21%.<sup>[6,7]</sup>

Previous reports confirmed that anxiety or depression can lead to poor patient compliance and increased hospital stay.<sup>[8-12]</sup> Therefore, it is important to evaluate the psychological state of the patient in time and provide psychological services accordingly. The impact of ovarian cancer on the psychosocial state of patients is a relatively neglected area of research. When a patient completes chemotherapy, this series of traumatic life events, including diagnosis of cancer, surgery, and chemotherapy, may cause aggravated anxiety and distress for the patients.

In this study, we aimed to investigate the levels of anxiety and depression in patients with ovarian cancer. We also investigated the dynamic changes in anxiety and depression levels before and after chemotherapy in patients with ovarian cancer. Independent factors that predict anxiety and depression in patients with ovarian cancer were identified. In addition, independent factors related to the relief of anxiety and depression after chemotherapy were also explored.

Editor: Daryle Wane.

The Institutional Review Board of Affiliated Hospital of Jining Medical University had approved this study. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

All authors declare that they have no financial or personal relationships with other people or organizations that could inappropriately influence this work.

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Medicine (2019) 98:31(e16620)

Received: 6 September 2018 / Received in final form: 24 June 2019 / Accepted: 5 July 2019

<http://dx.doi.org/10.1097/MD.00000000000016620>

**Table 1**  
**Characteristics of ovarian cancer patients and healthy controls.**

	Ovarian cancer patients	Healthy controls	P values
Sample Size	111	117	
Marital status			.712
Married	86	93	
Single	25	24	
Age, years	53.1 ± 11.9	55.5 ± 12.2	.122
Level of education			.604
Primary	48	43	
Secondary	37	44	
Tertiary	26	30	
Income			.960
Low	25	26	
Middle	50	51	
High	36	40	
FIGO stage			
I–II	23		
III–IV	88		

Level of education: Primary, Less than 1 years of formal school education; Secondary, 1 to 6 years of formal school education; tertiary, more than 6 years of study. Income: Low, less than 1999RMB/month; Middle, 2000 to 3999RMB/month; High, more than 4000RMB/month. FIGO = International Federation of Gynecology and Obstetrics.

## 2. Subjects and methods

### 2.1. Subjects

Patients diagnosed with epithelial ovarian cancer were enrolled in our center. Patients with central nervous system diseases were excluded from the study. A total of 117 females who underwent a physical examination at the same time were selected as healthy controls. The Institutional Review Board of Affiliated Hospital of Jining Medical University had approved the study. Sociodemographic information, such as marital status, age, education level, and income, were also collected for all participating subjects. The demographic and baseline characteristics of the 2 groups were shown in Table 1.

### 2.2. Questionnaires

All patients enrolled were asked to fill in the Self-rating Depression Scale (SDS) and the Self-rating Anxiety Scale (SAS). For patients with ovarian cancer, repeat SDS and SAS questionnaires were measured after cycle 1 chemotherapy. All of the subjects finished the questionnaires in a quiet room without any disruptions. They could get help from professional staff if they had problem in understanding the questions.

SDS: The SDS includes 20 items, and the scores of 20 items are added to obtain the total score. Depression was obtained by total score × 1.25. Patients with depression score < 50 were divided into depression-free group, and patients with ≥ 50 score were divided into depression group.<sup>[13,14]</sup>

SAS: The anxiety score calculated by SAS were proceeded in the same way as depression score calculated by SDS. Patients with SAS score ≥ 50 were regarded as having anxiety.<sup>[15,16]</sup>

### 2.3. Statistical analysis

Continuous variables were expressed as mean and standard deviation, and categorical variables were expressed as percentages. The Chi-Squared test and *t* test were applied to determine whether the results were statistically significant. Univariate and

multivariate analyses were used to evaluate the factor associated with depression and anxiety. The statistical significance of all tests was set as  $P < .05$  by 2-tailed tests. Data analyses and quality control procedures were performed using SPSS for Windows, version 13.0 (SPSS Inc. 233 South Wacker Drive, 11th Floor, Chicago, USA).

## 3. Results

### 3.1. Demographic data

A total of 228 patients who completed the questionnaires were included in this study. The characteristics of the subjects were shown in Table 1. All the patients were Chinese. There was no significant difference with regard to marital status, age, education level, and income level in ovarian cancer patients compared with healthy controls. The 2 groups were comparable.

### 3.2. Depression and anxiety level of ovarian cancer population

Thirty five patients with depression (SDS score ≥ 50) and 26 patients with anxiety (SAS score ≥ 50) were confirmed. The depression scores of patients with ovarian cancer were significantly higher than those of healthy controls. A similar trend was observed when comparing the anxiety scores of the 2 groups. The anxiety scores of patients with ovarian cancer were significantly higher than those of healthy controls (Fig. 1).

### 3.3. Factors associated with depression and anxiety of ovarian cancer patients

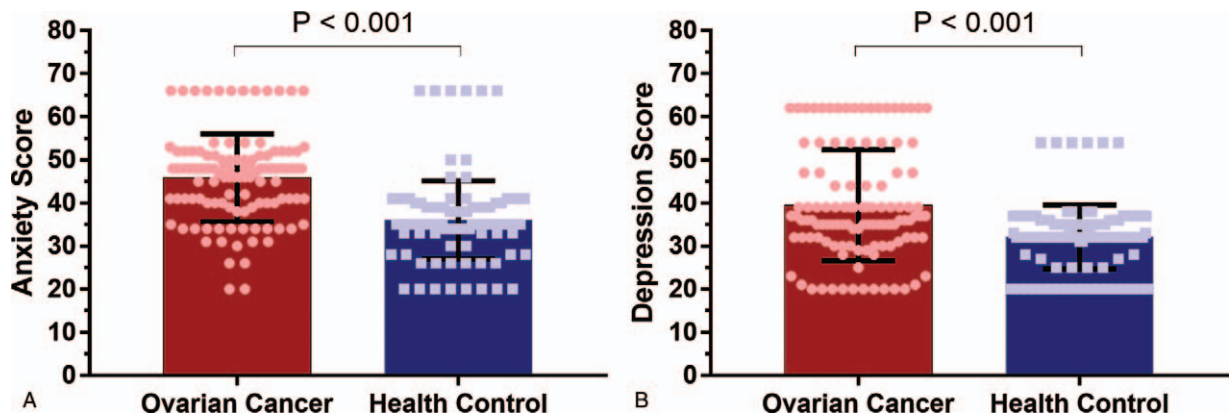
To explore the risk factors associated with depression and anxiety among ovarian cancer patients, the univariate and multivariate analyses were conducted. The results showed that young age was the only independent risk factor associated with depression among patients with ovarian cancer (Table 2). Although univariate logistic regression analysis indicated that single, young age, and high income were risk factors associated with anxiety, the multivariable analysis indicated that only young age and single were the independent risk factors associated with anxiety among patients with ovarian cancer (Table 3).

### 3.4. Dynamic change of depression and anxiety after chemotherapy

We also analyzed the scores of depression and anxiety in patients with ovarian cancer after chemotherapy. Interestingly, we found inconsistent distribution of depression and anxiety scores after the second questionnaire. The depression scores of patients with ovarian cancer decreased significantly after chemotherapy, but the anxiety scores increased significantly. The results were shown in Figure 2.

### 3.5. Factors associated with depression and anxiety remission after chemotherapy

To explore the most relevant factors associated with depression and anxiety remission of patients with ovarian cancer after chemotherapy, we conducted univariate and multivariate analyses. The univariate analysis showed that younger age, higher education level, higher income, and higher baseline



**Figure 1.** Depression and anxiety scores of ovarian cancer patients and healthy controls. The depression score of patients with ovarian cancer is  $45.90 \pm 10.19$ , significantly higher than in controls with  $36.08 \pm 9.06$  ( $P < .001$ ). Similar results were observed in anxiety score with  $39.53 \pm 12.92$  in ovarian cancer patients, significantly higher than in controls with  $32.15 \pm 7.44$  ( $P < .001$ ).

**Table 2**  
Factors associated depression among patients with ovarian cancer.

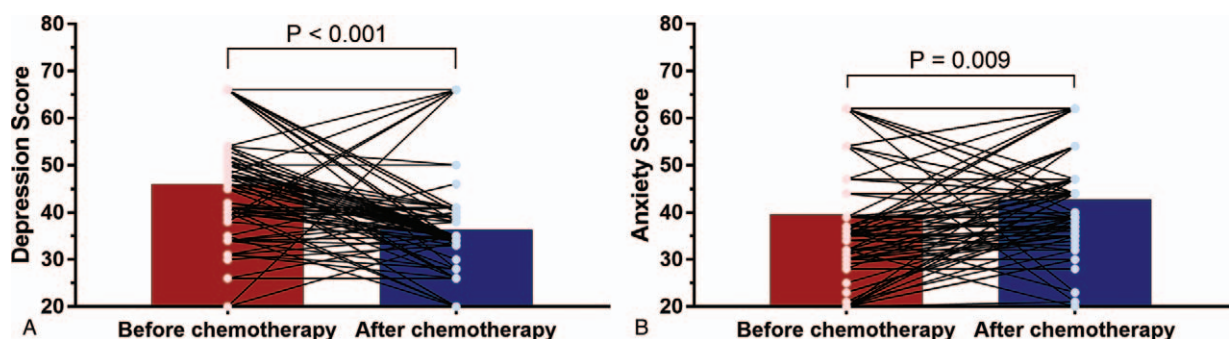
Variables	Univariate analysis			Multivariate analysis		
	OR	95%CI	P	OR	95% CI	P
Age (younger vs older)	0.83	0.75–0.91	<.001	0.83	0.75–0.91	<.001
Marital status (married vs single)	1.98	0.79–4.96	.14			
Level of education (primary vs tertiary)	1.29	0.74–2.25	.37			
Income (low vs high)	1.62	0.88–2.97	.12			

Level of education: Primary, Less than 1 years of formal school education; Secondary, 1 to 6 years of formal school education; tertiary, more than 6 years of study. Income: Low, less than 1999RMB/month; Middle, 2000 to 3999RMB/month; High, more than 4000RMB/month. OR=Odds Ratio.

**Table 3**  
Factors associated anxiety among patients with ovarian cancer.

Variables	Univariate analysis			Multivariate analysis		
	OR	95%CI	P	OR	95% CI	P
Age (younger vs older)	0.80	0.73–0.87	<.001	0.79	0.72–0.88	<.001
Marital status (married vs single)	2.90	1.29–6.54	.01	2.53	1.01–6.29	.047
Level of education (primary vs tertiary)	1.52	0.90–2.55	.12			
Income (low vs high)	2.30	1.27–4.16	0.006			

Level of education: Primary, Less than 1 years of formal school education; Secondary, 1 to 6 years of formal school education; tertiary, more than 6 years of study. Income: Low, less than 1999RMB/month; Middle, 2000 to 3999RMB/month; High, more than 4000RMB/month. OR=Odds Ratio.



**Figure 2.** Dynamic change of depression and anxiety score in ovarian cancer. Depression scores decreased from  $45.90 \pm 10.19$  to  $36.29 \pm 8.98$  after chemotherapy ( $P < .001$ ). Anxiety score rises from  $39.53 \pm 12.92$  to  $42.75 \pm 9.96$  after chemotherapy ( $P = .009$ ).

**Table 4**  
**Factors associated depression remission in ovarian cancer.**

Variables	Univariate analysis			Multivariate analysis		
	OR	95%CI	P	OR	95% CI	P
Age (younger vs older)	0.91	0.87–0.95	<.001			
Marital status (married vs single)	1.29	0.43–3.87	0.65			
Level of education (primary vs tertiary)	3.29	1.76–6.15	<.001			
Income (low vs high)	4.15	2.01–8.59	<.001	2.61	1.06–6.42	.036
Baseline depression score (low vs high)	1.21	1.11–1.30	<.001	1.17	1.08–1.27	<.001
FIGO stage (I–II vs III–IV)	1.52	0.84–2.59	.72			

Level of education: Primary, Less than 1 years of formal school education; Secondary, 1 to 6 years of formal school education; tertiary, more than 6 years of study. Income: Low, less than 1999RMB/month; Middle, 2000 to 3999RMB/month; High, more than 4000RMB/month.  
 OR=Odds Ratio, FIGO=International Federation of Gynecology and Obstetrics.

depression score were risk factors associated with depression remission. However, multivariate analysis suggested that only higher income and higher baseline depression score were the independent and most relevant risk factors associated with depression remission among patients with ovarian cancer after chemotherapy (Table 4). We further analyzed the factors associated with anxiety remission after chemotherapy. Although the results showed that younger age, higher level of education, higher income, and higher baseline anxiety score were risk factors associated with anxiety remission, only higher baseline anxiety score was the independent risk factor associated with anxiety remission (Table 5).

#### 4. Discussion

In this study, we found that the prevalence of anxiety and depression in patients with ovarian cancer was significantly higher than that in healthy controls. After chemotherapy, there was a remarkable change in anxiety and depression level. This change was not consistent. After chemotherapy, the depression score of patients with ovarian cancer was significantly reduced, but the anxiety score was significantly increased. To the best of our knowledge, this type of depression and anxiety change after chemotherapy has not been reported.

Depression and anxiety are common in patients with chronic diseases.<sup>[17–20]</sup> For example, in patients with chronic hepatitis B, long-term antiviral treatment can cause depression and anxiety.<sup>[21–23]</sup> In our study, we enrolled healthy people who matched the age of ovarian cancer patients as controls to exclude other factors, such as the patient's cultural background, ethnicity, age,

and so on. Although the scores of depression and anxiety are lower than the relevant diagnostic criteria, it is therefore better to screen out patients with ovarian cancer who have depression and anxiety. In this study, we found that depression scores and anxiety scores were significantly elevated in patients with ovarian cancer. This result is consistent with previous published studies.<sup>[24,25]</sup> We also found that younger age was a risk factor for depression in patients with ovarian cancer. For anxiety disorders, younger age and singleness were risk factors. This suggests that for young and single patients, timely psychological assessment and psychological intervention should be given to avoid adverse outcomes.

It seems that some patients may be aware of their health situation. But most of the ovarian cancer is asymptomatic. In fact, there are few internal signs or symptoms that can reflect the disease state of ovarian cancer. However, self-awareness of the disease state will usually aggravate anxiety.<sup>[26,27]</sup> In this study, we found that although the depression score decreased after chemotherapy, the anxiety score increased significantly. This result is worthy of further investigation. For patients with ovarian cancer, in addition to monitoring the patient's disease state after chemotherapy, timely update of the patient's mental state and timely detection and intervention of the patient's anxiety disorder are also very important.

The results in previous literature indicated that factors of physical disease were not associated with mental illness.<sup>[28–32]</sup> In this study, we found that high-income and higher baseline depression scores were risk factors for post-chemotherapy depression in patients with ovarian cancer. At the same time, we found that for subgroups of patients with high baseline

**Table 5**  
**Factors associated anxiety remission in ovarian cancer.**

Variables	Univariate analysis			Multivariate analysis		
	OR	95%CI	P	OR	95% CI	P
Age (younger vs older)	0.93	0.88–0.99	.015			
Marital status (married vs single)	1.58	0.57–4.39	.38			
Level of education (primary vs tertiary)	1.97	1.03–3.77	.04			
Income (low vs high)	2.56	1.27–5.18	.009			
Baseline anxiety score (low vs high)	1.13	1.08–1.18	<.001	1.13	1.08–1.18	<.001
FIGO stage (I–II vs III–IV)	1.44	0.91–2.15	.19			

Level of education: Primary, Less than 1 years of formal school education; Secondary, 1 to 6 years of formal school education; tertiary, more than 6 years of study. Income: Low, less than 1999RMB/month; Middle, 2000 to 3999RMB/month; High, more than 4000RMB/month.  
 OR=Odds Ratio, FIGO=International Federation of Gynecology and Obstetrics.

anxiety scores, they were more difficult to achieve relief from anxiety. It can be seen that the psychological state screening of the baseline information can reflect the subsequent changes in mental state. More frequent assessments of psychological status are necessary for patients with higher baseline depression scores and anxiety scores, especially for high-income people. In our study, the reason why younger age was associated with depression score and anxiety score and why the anxiety score increased after chemotherapy is that younger patients may have higher expectations for future life. Suffering from ovarian cancer can seriously affect their quality of life in the future and life expectancy. In this study, we found that anxiety score increased after chemotherapy although depression score decreased. One possibility explanation is that patients were depressed at the time of diagnosis and as they undertook treatment, they have gradually accepted the reality and become less depressed. Instead, they became more concerned about the side effects of treatments, the economic burden of the disease and the expectations of future life. Therefore, the anxiety level was increased after chemotherapy treatments.

There are some limitations in this study. Firstly, the sample size was relatively small, and all personnel were enrolled in the same center. Secondly, this study lacked the psychological state assessment of ovarian cancer patients. The psychological state of the patients will also change significantly before and after treatment. Data from patients with general sick condition and patients with all types of cancer should be included in the future research. In summary, in this study, we explored depression and anxiety in patients with ovarian cancer and explored factors associated with depression and anxiety. Psychological morbidity is a serious clinical problem in cancer patients. This study suggests that for patients with ovarian cancer, timely monitoring of the patient's psychological state, especially before and after chemotherapy treatment, is very important. Assessing the changes in the patient's psychological state, screening the population through risk factors and prompt intervention by mobilizing social support may be effective in preventing depression and anxiety in such population.

## Author contributions

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**Investigation:** Linqing Yang.

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**Supervision:** Hongxia Liu.

**Validation:** Hongxia Liu.

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**Writing – review & editing:** Hongxia Liu.

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