



Retrospective Study

Independent risk factors for depression in older adult patients receiving peritoneal dialysis for chronic kidney disease

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Abstract

BACKGROUND

According to the trend of global population aging, the proportion of elderly patients with chronic kidney disease (CKD) is expected to increase. However, there are more than 20 million people in China with decompensated kidney function, of which 19.25% are elderly people. Therefore, special attention should be paid to the education years, sleep quality, anxiety status, comorbidities with diabetes, cardiovascular disease (CVD), and anemia as independent risk factors for depression in elderly CKD patients. This study explores the clinical management of elderly CKD patients that should address these risk factors to prevent depression and improve their prognosis.

AIM

To investigate depression risk factors in older patients receiving peritoneal dialysis, aiding future prevention of depression in these patients.

METHODS

This retrospective study included a primary study population of 170 patients with CKD who received peritoneal dialysis from January 2020 to December 2022. We assessed the patients' mental status using the Beck Depression Inventory Score-II (BDI-II), Self-Rating Anxiety Scale (SAS), Anxiety Inventory Score, and the Pittsburgh Sleep Quality Index (PSQI). Logistic regression was employed to identify depression independent risk factors among these patients.

RESULTS

The non-depressed group had a significantly longer education period than the depressed group ($P < 0.05$). The depressed group exhibited significantly higher mental status scores than the non-depressed group ($P < 0.001$). Patients with diabetes mellitus (DM) or CVD had a higher probability of developing depression. Patients with depression had significantly lower hemoglobin and albumin levels than patients without depression ($P < 0.05$). Spearman correlation

analysis of BDI-II scale scores, measuring depression, indicated positive correlations with BDI-II and SAS scores as risk factors for depression in patients with CKD. In contrast, years of education, hemoglobin levels, and peritoneal Kt/V were negatively correlated, serving as protective factors against depression. An analysis of variance for influences with significant differences in the univariate analysis revealed that years of schooling, BDI-II, SAS, PSQI, DM, CVD, and hemoglobin levels independently influenced depression in older patients with CKD.

CONCLUSION

Education, BDI-II, SAS, PSQI, DM, and CVD are independent risk factors for depression in older patients with CKD; therefore, post-treatment psychological monitoring of high-risk patients is crucial to prevent depression.

Key Words: Depression; Chronic kidney disease; Peritoneal dialysis; Older adults; Risk factors for depression; Beck Depression Inventory Score-II

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Core Tip: We identified independent risk factors for depression in older patients with chronic kidney disease receiving peritoneal dialysis, including fewer years of education, higher Beck Depression Inventory Score-II and Self-Rating Anxiety Scale scores, poorer sleep quality, the presence of diabetes mellitus and cardiovascular disease, and lower hemoglobin and albumin levels. Conversely, more years of education, higher hemoglobin levels, and better peritoneal Kt/V ratio were associated with a lower risk of depression. These findings emphasize the importance of considering psychological well-being and addressing potential risk factors in the management of older patients on peritoneal dialysis, particularly in patients at high-risk of depression.

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INTRODUCTION

Chronic kidney disease (CKD), a severe condition, is associated with a group of syndromes and results from progressive kidney structure and function degradation over three months[1]. Patients with CKD exhibit clinical manifestations such as varying urinary protein levels, swelling, hypertension (HTN), and impaired kidney function[2]. Age significantly contributes to CKD, as kidneys decrease in size and lose with age[3]. In China, at least 20 million people have decompensated kidney function[4], with 19.25% being older adults. With global aging, the proportion of older patients with CKD is also likely to increase, necessitating special treatment and prognosis considerations.

Due to kidney shortages, CKD is often managed with renal replacement therapy, mainly hemodialysis and peritoneal dialysis[5]. Peritoneal dialysis utilizes the peritoneum as a semi-permeable membrane to remove dialysis fluid and metabolic waste[6]. Compared with hemodialysis, peritoneal dialysis is less expensive and has a lower ischemic effect on the kidneys, preserving residual function, and is more accessible[7]. However, CKD not only represents a financial burden to the patients but also leads to a rising rate of CKD-associated disabilities, causing patient suffering[8].

With advances in medical technology, the survival rates of patients with CKD is increasing, resulting in a growing population of patients with CKD[9]. Identifying means to improve their quality of life and prognosis has become a critical research focus. The prevalence of depression among patients with CKD is four times higher than that in the general population[10]. Among patients with CKD receiving ambulatory peritoneal dialysis, most often complain of poor sleep quality, moodiness, and lethargy, with a 58.1% prevalence of depression[11]. Despite variations in depression scales, ethnic groups, and geographic regions, various national and international studies have associated CKD-related depression to higher hospitalization rates, cardiovascular events, and suicide and mortality rates[12-14].

Based on the previous findings, this retrospective study explored the independent risk factors for depression in older patients with CKD receiving peritoneal dialysis to provide a scientific basis for reducing depression and improving the prognosis of older patients.

MATERIALS AND METHODS

Study participants and design

We selected 170 patients with CKD who received peritoneal dialysis treatment at the Cangzhou Central Hospital in the Hebei Province from January 2020 to December 2022. The study was approved by the ethics committee of the Cangzhou Central Hospital and all participants signed informed consent. The patient inclusion criteria were: (1) Age > 65 years; (2)

Met the diagnostic criteria for patients with CKD receiving peritoneal dialysis; (3) Ambulatory with unrestricted activity; and (4) No comorbid psychiatric conditions prior to observation and conscious and able to communicate autonomously. Patients were excluded if they had: (1) An emergency cardiovascular event with impaired consciousness; (2) other serious illnesses, such as cancer, myocardial infarction, and cerebrovascular accident (CVA); and (3) depression and anxiety before receiving peritoneal dialysis.

This retrospective study analyzed patients previously treated with peritoneal dialysis, collected their basic information and clinical data, and assessed their mental status using the Beck Depression Inventory Score-II (BDI-II), Self-Rating Anxiety Scale (SAS), Anxiety Inventory Score, and the Pittsburgh Sleep Quality Index (PSQI).

Clinical characteristics

Demographic information and prevalence data were collected from all participants. These data included age, sex, education level, body mass index (BMI), presence of HTN, presence of diabetes mellitus (DM), and history of cardiovascular disease (CVD). CVDs included coronary heart disease, congestive heart failure, myocardial infarction, and a history of CVA.

Laboratory methods

Peritoneal dialysis was continued after the patients were given a night meal. Venous blood was collected from all participants for routine blood tests. Blood tests were conducted using a fully automated chemistry analyzer (indicators included serum sodium, albumin, calcium, phosphate, cholesterol, and hemoglobin). Midmorning urine samples were collected to determine renal function. The total Kt/V and creatinine clearance of the patients' body after peritoneal dialysis were evaluated to determine the effectiveness of dialysis treatment.

Depressive state measurement

The BDI-II, SAS Anxiety Inventory Score, and PSQI scores were used to measure the depression status of the patients.

BDI-II: This scale assesses the degree of depression. It consists of 21 groups of items, with each group having four statements. Each question is scored from 0 to 3. Depression was classified as follows: patients with scores < 13 were considered non-depressed, 14–19 were considered mildly depressed, 20–28 were considered moderately depressed, and 29–63 were considered severely depressed[15].

SAS: This scale assesses the degree of anxiety. The standard SAS score has a cutoff of 50, with 50–59 indicating mild anxiety, 60–69 indicating moderate anxiety, and 70 or more indicating severe anxiety[16].

PSQI: This index is used to assess sleep quality over the last month. The total PSQI score ranges from 0 to 21. A negative correlation was observed between these scores and sleep quality (higher scores indicating poorer sleep quality). A score > 16 indicated poor sleep quality[17].

Statistical analysis

The data were processed using SPSS 26.0, with measurements expressed as the mean $\pm$ SD. Analysis of variance (ANOVA) or Student's *t*-test was performed to evaluate statistical significance. The *t*-test for independent samples was performed to compare the data between the two groups, and the chi-square test was performed to compare the count data in terms of composition ratio (%). Correlations were analyzed using the Spearman method, and influencing factors were analyzed using multiple linear regression models, with $P < 0.05$ considered as a statistically significant difference. Spearman's rank correlation was used to analyze the relationship between depression and each parameter, and logistic regression was performed to analyze the factors influencing depression.

RESULTS

Patient baseline characteristics

We collected demographic data and medical histories for analysis (Table 1). Among 170 patients, 59 were assessed as having depression based on the scale and clinical symptoms. Age, BMI, HTN, triglyceride, P, Ca, Na levels, and renal function did not significantly differ between the depressed and non-depressed groups ($P > 0.05$). However, a significant difference was observed in the length of education between the two groups ($P < 0.05$). The depressed group had significantly higher mental state scores compared to the control group ($P < 0.001$). Patients with DM and CVD were more prone to develop depression, and those in the depressed group had significantly lower hemoglobin and albumin levels than patients in the non-depressed group ($P < 0.05$).

Correlation between depression and relevant indicators in peritoneal dialysis patients

The results of the Spearman correlation analysis of BDI-II scale scores measuring depression with each factor revealed that BDI-II and SAS scores were positively correlated as risk factors for depression in patients with CKD. In contrast, years of education, hemoglobin levels, and peritoneal Kt/V were negatively correlated as protective factors against depression (Table 2).

Dichotomous logistic regression analysis of patient depression

ANOVA results revealed that years of schooling, BDI-II, SAS, PSQI, DM, CVD, and hemoglobin levels independently influenced depression in older patients with CKD (see Table 3 for indicator assignments) (Table 4).

Table 1 The baseline characteristics of the study patients

Factors	No-depression (n = 59)	Depression (n = 111)	P value
Age (yr, mean $\pm$ SD)	67.23 $\pm$ 0.23	68.11 $\pm$ 0.36	0.590
Sex (male/female)	78/33	41/18	0.975
BMI (kg/m ² , mean $\pm$ SD)	22.10 $\pm$ 0.55	20.83 $\pm$ 0.40	0.057
Year of education (yr)	8.0 $\pm$ 0.50	5.5 $\pm$ 0.50	0.021 ¹
Mental State Scale scores			
BDI-II	5.72 $\pm$ 0.92	18.13 $\pm$ 0.21	< 0.001 ³
SAS	44.11 $\pm$ 1.02	60.92 $\pm$ 2.90	< 0.001 ³
PSQI	3.90 $\pm$ 0.67	19.02 $\pm$ 0.82	< 0.001 ³
Medical history			
HTN	21(35.59%)	41 (36.94%)	0.056
DM	35(59.32%)	56 (50.45%)	< 0.001 ³
CVD	12(20.33%)	24 (21.62%)	< 0.001 ³
Physical examination			
Albumin (g/L)	37.78 $\pm$ 0.41	31.27 $\pm$ 0.13	0.002 ²
Hemoglobin (g/L)	121.40 $\pm$ 11.90	103.90 $\pm$ 13.33	0.031 ¹
Triglycerides (mmol/L)	1.98 $\pm$ 0.59	1.56 $\pm$ 0.46	0.072
P (mmol/L)	1.82 $\pm$ 0.35	1.74 $\pm$ 0.12	0.197
Ca (mmol/L)	2.34 $\pm$ 0.19	2.24 $\pm$ 0.26	0.237
Na (mmol/L)	137.25 $\pm$ 12.60	135.01 $\pm$ 15.06	0.892
Renal function			
Scr (μ mol/L)	352.15 $\pm$ 15.65	350.21 $\pm$ 15.96	0.145
BUA (μ mol/L)	369.78 $\pm$ 14.69	357.37 $\pm$ 14.34	0.774
Residual renal Kt/V	0.28 $\pm$ 0.09	0.26 $\pm$ 0.07	0.132
Peritoneal Kt/V	1.56 $\pm$ 0.10	1.54 $\pm$ 0.21	0.521

¹P < 0.05.²P < 0.01.³P < 0.001.

HTN: Hypertension; DM: Diabetes Mellitus; CVD: Cardiovascular Disease; BDI-II: Beck Depression Inventory-II; SAS: Self-Rating Anxiety Scale; PSQI: Pittsburgh Sleep Quality Index; Scr: Serum creatinine; BUA: Blood uric acid.

DISCUSSION

Because the older adult population comprises an increasing proportion of patients with CKD, improving their quality of life and prognostic outcomes has become a priority for their clinical management. Depression often results in reduced sleep quality and worry in older patients, which can lead to self-harm and, in severe cases, to suicidal behavior. Studies have evidenced that patients with CKD are more prone to depression than patients without CKD, possibly due to prolonged dialysis treatment and physical and psychological stress[18]. In this retrospective study, we analyzed cross-sectional data and the results revealed that indicators such as years of education and sleep quality are independent risk factors for depression in older patients with CKD.

Association between years of schooling and depression

Educational attainment has consistently been considered as a protective factor against depression. Our study reinforces this connection, revealing a significant negative correlation between that years of education and depression scores. Higher education often equates to lower depression rates associated to greater financial stability and access to health knowledge, fostering better acceptance of the patient's condition[19]. Moreover, the alleviating effect of education on depression increases with age[20]. Therefore, the protective effect of education on depression is more likely to be noted in the older adult population.

Table 2 Correlation between depression and relevant indicators in peritoneal dialysis patients

Factors	r_s	<i>P</i> value
Year of education	-0.415	< 0.001 ³
BDI-II	0.925	0.015 ²
SAS	0.982	< 0.001 ³
Hemoglobin	-0.332	0.002 ²
Peritoneal Kt/V	-0.456	0.023 ¹

¹*P* < 0.05.²*P* < 0.01.³*P* < 0.001.

BDI-II: Beck Depression Inventory-II; SAS: Self-Rating Anxiety Scale.

Table 3 Influencing factor assignments

Factors	Assignment
Years of schooling	> 6 yr = 0, < 6 yr = 1
BDI-II	< 14 score = 0, ≥ 14 score = 1
SAS	< 50 score = 0, ≥ 50 score = 1
PSQI	< 16 score = 0, ≥ 16 score = 1
DM	No = 0, yes = 1
CVD	No = 0, yes = 1
Albumin	≥ 35 = 0, < 35 = 1
Hemoglobin	< 110 = 1, ≥ 110 = 1

BDI-II: Beck Depression Inventory-II; SAS: Self-Rating Anxiety Scale; PSQI: Pittsburgh Sleep Quality Index; DM: Diabetes Mellitus; CVD: Cardiovascular Disease.

Table 4 Dichotomous logistic regression analysis of patient depression

Indices	β	Wald	<i>P</i> value	OR	95% CI
Years of schooling	1.519	1.628	0.025 ¹	0.971	0.921-0.987
BDI-II	0.116	5.177	< 0.001 ³	0.258	0.215-0.267
SAS	0.059	2.648	< 0.001 ³	1.605	1.420-1.700
PSQI	0.169	11.029	< 0.001 ³	0.157	0.144-0.162
DM	0.126	8.053	< 0.001 ³	1.264	1.201-1.274
CVD	0.236	2.615	0.002 ²	0.584	0.573-0.600
Albumin	-0.300	5.641	0.051	1.177	1.059-1.208
Hemoglobin	-0.321	3.641	< 0.001 ³	1.060	0.998-1.105

¹*P* < 0.05.²*P* < 0.01.³*P* < 0.001.

BDI-II: Beck Depression Inventory-II; SAS: Self-Rating Anxiety Scale; PSQI: Pittsburgh Sleep Quality Index; DM: Diabetes Mellitus; CVD: Cardiovascular Disease.

Studies have suggested that the education might strengthen the resilience of patients with CKD, reducing their susceptibility to depression. Our findings highlight that patients with lower educational levels are more prone to depression. In China, the majority of the older adults has a low education level, with a 13.90% of those aged ≥ 60 years having a high school education or higher as of 2021. This proportion may be even lower among older patients with CKD who have depression[21].

Association of sleep quality and anxiety with depression

Sleep quality and anxiety levels often conform with depression. Studies have reported that people experiencing poor sleep quality and higher anxiety levels are more likely to develop depression. This result is consistent with that of our study[22]. Sleep quality is crucial for health; however, older adults have significantly shorter sleep duration and generally poorer sleep quality than people from other age groups. From a neurobiological perspective, people with insomnia tend to exhibit increased activity in their arousal systems, leading to alterations in corticothalamic neural activity and neurotransmitter release. This includes the production of high levels of adrenocorticotrophic hormones and cortisol, factors that increase susceptibility to mental health conditions such as depression and anxiety[23]. Sleep quality influences cognitive function as well as anxiety and depression in older adults. For example, Wang *et al*[24] found a significant association between sleep disturbance and depression scale and geriatric anxiety scale scores in Asian older adults. Therefore, monitoring sleep quality is crucial for the effective management of older patients with CKD.

Association of DM and CVD with depression

A large proportion of patients with Parkinson's disease develop diabetic nephropathy. A meta-analysis revealed a bidirectional association between diabetic nephropathy and depression. Similarly, a Japanese survey reported that the progression of diabetic nephropathy might increase the risk and severity of depression[25]. In cases of diabetic nephropathy, patients require long-term medication or insulin injections to control their blood glucose. Prolonged exposure to this disease can exacerbate depression. This depressive state may make patients less able to self-regulate and less aware of health protection, thereby exacerbating their overall medical condition, which can lead to progressive kidney failure.

Proteinuria is a risk factor of CVD. Advanced kidney disease can be exacerbated by CVD, leading to higher levels of depression[26]. Thus, a history of CVD is also a risk factor for depression in older patients with CKD[27]. The incidence of CVD tends to increase significantly with age; therefore, older patients with CKD are more likely to experience cardiovascular events that can exacerbate depression than the general population.

The relationship between anemia and depression

Anemia is a common complication in patients undergoing peritoneal dialysis and is caused by reduced erythropoietin production, toxin accumulation-induced erythropoietic depressants, shortened erythrocyte survival, and iron deficiency. Anemia is significantly associated with quality of life, CVD, hospital admissions, cognitive impairment, and death. In addition, patients with anemia often exhibit poor concentration and may also experience syncope and myocardial infarction, which can seriously affect their normal life and work[28]. Increased dyspnea and fatigue due to anemia may lead to a substantial decrease in physical and social activity, which in turn may increase depression. Hemoglobin and albumin levels serve as markers for anemia, and these two indicators were among the risk factors for depression in older patients with CKD, with a significantly higher incidence of depression in patients with anemia than in patients who did not present this condition.

Strengths and limitations

A strength of this study is its retrospective design, which enabled the analysis of independent risk factors associated with depression in older patients with CKD, providing a wider understanding of the patients' condition. Through correlation and logistic regression analyses, involving various factors associated with the incidence of depression in patients with CKD, the study compiled robust evidence, lending to more reliable results.

A limitation of this study is the absence of a comparative analysis involving other age groups. Therefore, the applicability of the study's findings is limited to the older adult population. However, at this stage, CKD patients are predominantly old. Although we believe that our findings can be generalized to other age groups, further studies are warranted to validate these hypothesis.

CONCLUSION

This study evidenced that years of education, sleep quality, anxiety status, comorbid DM, CVD, and anemia were independent risk factors for depression in older patients with CKD. Moreover, clinical management of older patients with CKD should address these risk factors to prevent depression and improve their prognosis.

ARTICLE HIGHLIGHTS

Research background

Previous studies demonstrated that over 20 million people in China experience decompensated kidney function, with 19.25% of them being older adults. Given the trend in global aging population, the proportion of older patients with chronic kidney disease (CKD) is expected to increase. Therefore, special attention should be focus on the treatment and prognosis of older patients with CKDs.

Research motivation

This study aimed to investigate the independent risk factors for depression in older patients with CKD undergoing peritoneal dialysis.

Research objectives

The study aimed to provide a clinical basis for the prevention of depression in older patients with CKDs.

Research methods

This retrospective study included a primary study population of 170 patients with CKD who received peritoneal dialysis from January 2020 to December 2022. We assessed the patients' mental status using the Beck Depression Inventory Score-II, Self-Rating Anxiety Scale, Anxiety Inventory Score, and the Pittsburgh Sleep Quality Index. Logistic regression was employed to identify depression independent risk factors among these patients.

Research results

The results of this study suggest that years of education, sleep quality, anxiety status, comorbid diabetes, cardiovascular diseases, and anemia are independent risk factors for depression in older patients with CKDs.

Research conclusions

This study found that years of education, sleep quality, anxiety status, comorbid diabetes mellitus, cardiovascular disease, and anemia were independent risk factors for depression in older patients with CKDs, and future clinical management of patients should address these risk factors to prevent depression and improve prognosis.

Research perspectives

This study investigated the independent risk factors for depression in older patients with CKD to provide a scientific basis for improving their prognosis, as well as to reduce the risk of depression in old age.

FOOTNOTES

Author contributions: Sheng YP, Ma XY, Liu Y, Yang XM and Sun FY designed the research; Sheng YP, Sun FY, Ma XY performed the research; Liu Y and Yang XM contributed new reagents/analytic tools; Sheng YP, Sun FY and Liu Y analyzed the data; Sheng YP, Sun FY and Ma XY wrote the paper.

Institutional review board statement: This study has passed the ethical review and approval of Cangzhou Central Hospital.

Informed consent statement: The study has obtained informed consent from the patient or the patient's guardian.

Conflict-of-interest statement: The authors declare that there are no conflicts of interest.

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