

A column chart study of cognitive deficits in postpartum depression patients following pharmacologic therapy

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Abstract: Objective: to construct a column-line graph prediction model of cognitive impairment in postpartum depression patients treated with medication and evaluate its efficacy. Methods: 120 patients with postpartum depression admitted to our hospital between August 2023 and June 2024 were selected as the study subjects, and were categorized into 81 cases in the non-occurrence group and 39 cases in the occurrence group by MoCA score. After unifactorial and multifactorial logistic regression analyses, the influencing factors of cognitive impairment were screened out, and a column-line graphical model was constructed to assess their predictive efficacy. Results: The results of univariate analysis showed comparisons of literacy, intraoperative bleeding, alcohol consumption, smoking, SSRS score, DA, E1, E2, BDNF, 5-HT, PRL, FSH, and LH ($P < 0.05$), and multifactorial analysis showed that all of the above factors were risk factors for cognitive dysfunction, and the construction of the column-line diagram showed a significant efficacy with a sensitivity and accuracy of more than 80%. Conclusion: Column line plots predicted the risk of cognitive dysfunction after medication in patients with postpartum depression with significant efficacy.

Keywords: Postpartum depression; Sertraline; Cognitive impairment; Columnar graphs

Postpartum depression is a common disease that can be triggered by childbirth, intimate partner violence, prenatal depression, adverse life events, etc. According to statistics, about 10% to 15% of pregnant women will be affected. It is a major public health issue, which not only affects the physical and mental health of the mother, but also affects the cognitive, physical and emotional development of the infant^[1,2]. Previous studies suggest that^[3,4], After effective psychological and drug treatment, patients with postpartum depression can have their social functions well restored. Recent studies have mentioned^[5,6], After drug treatment, some postpartum women often experience cognitive impairment, which has a significant impact on their future recovery and return to the workplace and society, and also increases the pressure of subsequent treatment. However, the causes of cog-

nitive impairment in postpartum depression patients after drug treatment remain unclear at present, which can be regarded as a direction worth exploring. Meanwhile, in clinical practice, the nomogram analysis model has advantages such as intuitive prediction and strong comprehensiveness, and is widely applied in risk assessment. Based on this, this study identified the risk factors for cognitive impairment in patients with postpartum depression after drug treatment, constructed a nomogram model, and evaluated its predictive efficacy.

1. Materials and methods

1.1 Research Object

A total of 120 patients with postpartum depression admitted to our hospital from August 2023 to June 2024 were selected as the research subjects. This research has been approved by the ethics committee of our hospital.

Inclusion criteria: ① Comply with the diagnostic criteria for postpartum depression as stipulated in the “Expert Consensus on Comprehensive Prevention and Treatment Strategies and Techniques for Depressive Disorders in Pregnant and Postpartum Women”^[7]; ② Complete clinical data; ③ There was no cognitive impairment before drug treatment; ④ Actively cooperate with the treatment; ⑤ Good language, writing and communication skills.

Exclusion criteria: ① Severe organic brain diseases; ② Severe suicidal tendencies; ③ A history of mental disorders in the past; ④ Major unexpected events such as major changes in family members or spouses during pregnancy; ⑤ Those with concurrent malignant tumors.

1.2 Research Methods

All patients received sertraline hydrochloride tablets (Vante Pharmaceutical (Hainan) Co., LTD.) after admission. National Drug Approval No. H20080019 Oral treatment: 50mg*14 tablets. The initial dose is 50mg per time, and then gradually increase to 100mg per day. After 12 weeks of treatment, the patients were grouped based on the scores of the Montreal Cognitive Assessment Scale (MoCA)^[8]. The MOCA includes 8 cognitive domains, namely abstract thinking, executive ability, memory, calculation, attention concentration, orientation, visual structure skills, and language, with a total of 11 items and a full score of 30. A score of 26 or above is considered normal. As the non-occurrence group (n=81); When the score is less than 26 points, it is regarded as cognitive impairment and is classified as the occurrence group (n=39).

1.3 Observation Indicators

(1) Sort out and statistically analyze the age of the two groups of patients, whether there is sleep disorder, analgesic method, number of deliveries, body mass index, mode of delivery, number of pregnancies, monthly family income, educational level, 17-item Hamilton Depression Scale (HAMD-17) score, alco-

hol consumption, degree of depression, intraoperative blood loss, family history, smoking and Social Support Rating Scale (SSRS) score. (2) Sex hormones and neurotransmitter factors: On the day of 12 weeks of treatment, 5mL of fasting elbow venous blood was collected. After centrifugation at 3000r/min for 15 minutes, the supernatant was taken. The levels of estrone (E1), estradiol (E2), prolactin (PRL), follicle-stimulating hormone (FSH), luteinizing hormone (LH), dopamine (DA), norepinephrine (NE), brain-derived neurotrophic factor (BDNF), and 5-hydroxytryptophan (5-HT) were detected using an enzyme-linked immunosorbent assay kit.

1.4 Statistical Analysis

Data were analyzed and processed using SPSS25.0 software. The measurement data conformed to a normal distribution. Independent sample t-tests were performed for data comparison between the two groups, which were expressed as ($\bar{x} \pm s$). The data of the two groups of count data were compared by chi-square test and expressed as (n (%)). Multivariate Logistic regression was used to analyze the risk factors for cognitive impairment, and a nomogram model was constructed. The predictive efficacy was analyzed using the ROC curve. $P < 0.05$, and the difference was statistically significant.

2. Results

2.1 Univariate analysis of risk factors for cognitive impairment in patients with postpartum depression after drug treatment

As shown in **Table 1**, there were no statistically significant differences between the two groups of patients in terms of age, number of deliveries, analgesic methods, body mass index, HAM-D-17 score, mode of delivery, number of pregnancies, monthly family income, degree of depression, presence or absence of sleep disorders, and family history ($P > 0.05$). There were statistically significant differences in educational level, intraoperative blood loss, alcohol consumption, smoking and SSRS score between the two groups ($P < 0.05$).

Table 1. Univariate analysis of risk factors for cognitive impairment after medication in patients with postpartum depression

Project		Non-occurring group(n=81)	Occurring group(n=39)	t/x ²	P
Age (years)		26.39±2.86	26.01±2.73	0.692	0.491
Body mass Index(kg/m ²)		24.53±3.29	23.85±3.06	1.084	0.280
Number of pregnancies (times)		2.06±0.43	2.12±0.51	0.673	0.502
Number of births (times)		1.86±0.38	1.91±0.39	0.669	0.505
Literacy (n, %)	Junior high school and below	26(32.10)	22(56.41)	7.920	0.019
	High school and technical secondary school	36(44.44)	14(35.90)		
	College degree or above	19(23.46)	3(7.69)		
Monthly household income (n, %)	< 5000	16(19.75)	11(28.21)	1.079	0.299
	≥5000	65(80.25)	28(71.79)		
Mode of delivery (n, %)	Natural delivery	29(35.80)	12(30.77)	0.297	0.586
	Cesarean section	52(64.20)	27(69.23)		

Intraoperative blood loss (n, %)	< 500	21(25.93)	21(53.85)	9.020	0.003
	≤500	60(74.07)	18(46.15)		
Are there any sleep disorders (n, %)	yes	33(40.74)	22(56.41)	2.604	0.107
	no	48(59.26)	17(43.59)		
Family history (n, %)	yes	26(32.10)	14(35.90)	0.171	0.679
	no	55(67.90)	25(64.10)		
Degree of depression (n, %)	Mild	41(50.62)	16(41.03)	0.972	0.615
	Moderate	26(32.10)	15(38.46)		
	Severe	14(17.28)	8(20.51)		
Smoking (n, %)	yes	58(71.60)	35(89.74)	4.967	0.026
	no	23(28.40)	4(10.26)		
Drinking alcohol (n, %)	yes	26(32.10)	23(58.97)	7.870	0.005
	no	55(67.90)	16(41.03)		
HAMD-17 score (points)		28.95±3.16	28.76±3.14	0.309	0.758
SSRS score (points)		25.76±2.43	20.42±1.15	13.019	<0.001

2.2 Compare the levels of sex hormones in the two groups

As shown in **Table 2**, compared with the non-occurrence group, the levels of E1 and E2 in the occurrence group decreased, while the levels of PRL, FSH and LH increased, and the differences were statistically significant ($P<0.05$).

Table 2. compares the levels of sex hormones in the two groups($\bar{x} \pm s$)

Group	n	E2(pg/mL)	E1(pg/mL)	PRL(μg/L)	LH(U/L)	FSH(U/L)
Non-occurring group	81	60.35±15.08	20.54±5.13	15.21±3.80	21.43±5.36	27.46±6.86
Occurring group	39	51.24±12.81	16.97±4.24	19.35±4.83	25.34±6.33	32.15±8.04
t		3.249	3.768	5.107	3.525	3.314
P		0.002	<0.001	<0.001	0.001	0.001

2.3 Compare the levels of neurotransmitter hormones in the two groups

As shown in **Table 3**, compared with the non-occurrence group, the levels of DA, BDNF and 5-HT in the occurrence group decreased, and the difference was statistically significant ($P<0.05$).

Table 3. compares the levels of neurotransmitter hormones between the two groups($\bar{x} \pm s$)

Group	n	DA(ng/L)	5-HT(ng/mL)	NE(ng/L)	BDNF(μg/L)
Non-occurring group	81	40.15±10.03	284.65±71.16	142.16±35.54	36.42±9.11
Occurring group	39	34.29±8.57	251.49±62.87	131.43±32.85	31.81±7.95
t		3.137	2.480	1.587	2.702
P		0.002	0.015	0.155	0.008

2.4 Multivariate analysis of risk factors for cognitive impairment in patients with postpartum depression after drug treatment

As shown in **Table 4**, taking the occurrence of cognitive impairment in patients with postpartum depression after drug treatment (occurrence =1, non-occurrence =0) as the dependent variable, the educational level (college degree and above =0, high school and secondary technical school =1, junior high school and below =2), intraoperative blood loss ($\leq 500\text{mL}=0$, $> 500\text{mL}=1$), alcohol con-

sumption (no =0, yes =1), and smoking (no =0) were taken into account. It is =1) and continuous variables SSRS score, DA, E1, E2, PRL, BDNF, FSH, 5-HT, LH. The results of multivariate Logistic regression analysis showed that intraoperative blood loss, PRL, alcohol consumption, SSRS score, BDNF, educational level, DA, smoking, FSH, E1, 5-HT, LH, and E2 were independent risk factors for cognitive impairment.

Table 4. Multivariate analysis of risk factors for cognitive impairment in patients with postpartum depression after drug treatment

Factor	β	SE	Wald	OR	P	95%CI
Literacy	1.165	0.436	7.140	3.206	0.019	2.334~4.078
Intraoperative blood loss	1.539	0.559	7.580	4.660	0.003	3.542~5.778
Smoking	1.452	0.408	12.665	4.272	0.026	3.456~5.088
Drinking alcohol	1.354	0.391	11.992	3.873	0.005	3.091~4.655
SSRS score	1.306	0.358	13.308	3.691	<0.001	2.975~4.407
E2	1.349	0.519	6.756	3.854	0.002	2.816~4.892
E1	1.408	0.487	8.359	4.088	<0.001	3.114~5.062
PRL	1.491	0.501	8.857	4.442	<0.001	3.440~5.444
LH	1.503	0.546	7.578	4.495	0.001	3.403~5.587
FSH	1.215	0.392	9.607	3.370	0.001	2.586~4.154
DA	1.183	0.354	11.168	3.264	0.002	2.556~3.972
5-HT	1.024	0.391	6.859	2.784	0.015	2.002~3.566
BDNF	1.248	0.419	8.872	3.483	0.008	2.645~4.321

2.5 Build a nomogram model

As shown in Figure 1 Based on the results of multivariate Logistic regression analysis, the model regression equation was obtained as logit (P) =0.986+1.165× educational level +1.539× intraoperative blood loss +1.452× smoking +1.354× drinking +1.306×SSRS score +1.349×E2×1.408×E1+1.491×PRL+1.503×LH+1.215×FSH+1.183×DA+1.024×5-HT+1.248×BDNF, the model is presented in the form of a nomogram.

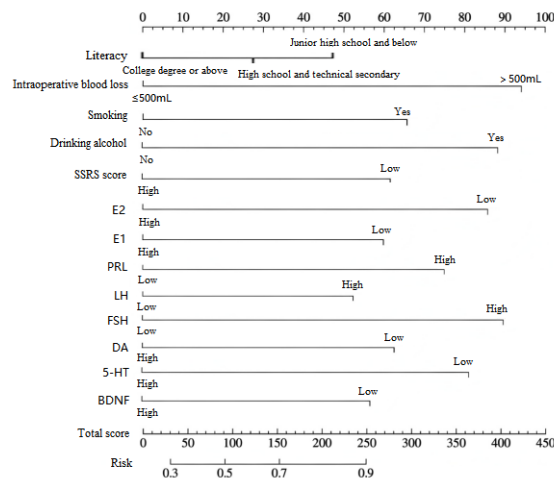


Figure 1. Nomogram model

2.6 Predictive Performance of the nomogram Model

As shown in **Table 5** and **Figure 2**, the ROC curve was plotted to evaluate the predictive ability of the nomogram model. The results indicated that the AUC value of the prediction model was 0.901, with both sensitivity and accuracy exceeding 80%, suggesting significant predictive efficacy. Meanwhile, the evaluation results using the standard curve and the correction curve showed that the average absolute error was 0.219, indicating that the model had a good correction effect.

Table 5. Prediction Performance of the nomogram Model

Project	AUC	Sensitivity	Specificity	Accuracy	95%CI
Nomogram model	0.901	92.31(36/39)	79.01(64/81)	83.33(100/120)	0.831~0.971

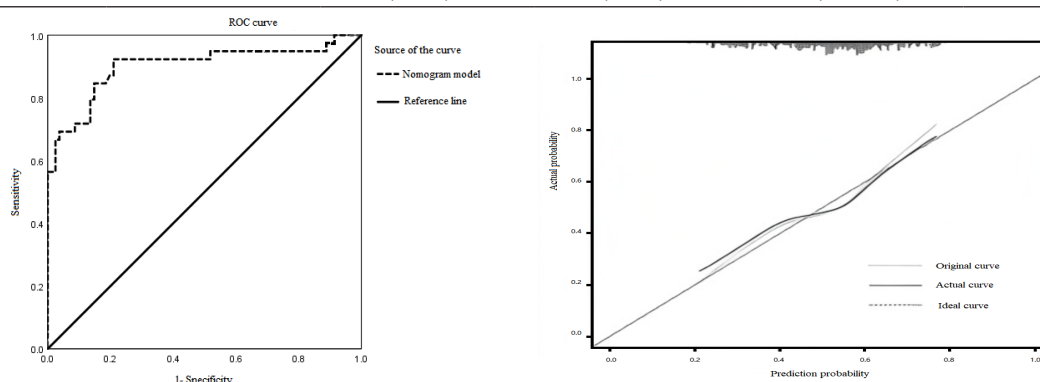


Figure 2. The predictive performance of the nomogram model

3. Discussion

The results of this study show that among 120 patients with postpartum depression, 39 (32.50%) developed cognitive impairment after drug treatment, while the remaining 81 (67.50%) did not. Significant psychological and physiological changes can occur in parturients before and after childbirth. Some parturients develop depression after giving birth, and the duration of symptoms varies. Most recover within a few days after delivery, but there are still some parturients whose symptoms persist and cannot be relieved even after drug treatment. In severe cases, it can trigger a stress response and lead to cognitive impairment^[9]. Therefore, it is even more crucial to promptly identify the risk of cognitive impairment that patients with postpartum depression may face after drug treatment and accordingly carry out targeted preventive measures.

In this study, intraoperative blood loss, alcohol consumption, SSRS score, smoking, educational level, sex hormones and neurotransmitter factors were all independent risk factors for the occurrence of cognitive impairment. Analysis of the reasons: (1) The central nervous system is more sensitive to hypoxia-ischemia conditions. The amount of intraoperative blood loss has a significant impact on the oxygen and blood supply status of the central nervous system. Large intraoperative blood loss can cause insufficient cerebral blood perfusion, thereby reduc-

ing cognitive function ^[10]; (2) Alcohol is an anesthetic. Long-term use can affect the central nervous system, leading to cognitive impairment symptoms such as memory decline and slow thinking, and reducing the patient's control ability. At the same time, the nicotine component in tobacco affects the production of synapses and brain neurons, aggravating the damage of alcohol and tobacco to the brain, further affecting the treatment effect, and worsening cognitive impairment ^[11]. (3) Social support is an intermediate variable between depression and stressful life events. When patients do not receive support and care from society and their families, it is prone to cause significant psychological discomfort, leading to symptoms such as helplessness, loss, and unease, which in turn aggravates depressive moods and reduces cognitive function ^[12]. (4) There is a positive correlation between educational attainment and cognitive function. The higher the educational level, the longer the theoretical education they have received, and they have a certain knowledge foundation. They pay attention to learning knowledge related to pregnancy and childbirth through the Internet, community promotion and other means, and have a comprehensive understanding of health care knowledge. However, the lower the educational level, the weaker the understanding of disease-related knowledge, which may further aggravate cognitive impairment ^[13]. Abnormal changes in sex hormone levels can lead to the decline of functions of endocrine-related organs, such as the pituitary gland and hypothalamus in women, inducing disorders in the body's endocrine system, disrupting the internal environment, and making it more prone to psychological disorders and even cognitive impairments ^[14,15]. (6) The levels of monoamine neurotransmitters are influenced by sex hormones, reducing the levels of DA, BDNF, and 5-HT, which makes patients more prone to cognitive dysfunction ^[16]. The nomogram model constructed based on the above factors has a sensitivity and accuracy of over 80%, with good discrimination ability. After the consistency evaluation of the model, a standard correction curve was generated, with an average error of 0.219, indicating that the model has good calibration consistency and high prediction efficiency.

In conclusion, this study established a predictive model for cognitive impairment after drug treatment for postpartum depression. This model has a significant efficacy in predicting the risk of cognitive impairment, which is conducive to the early implementation of risk management and the formulation of targeted treatment plans in later clinical practice. However, due to time constraints, the sample size and sample period included in this study were limited. The analysis of influencing factors was too one-sided, ignoring the impact of drug treatment itself. Relevant research needs to be conducted in the future to provide more reliable and detailed treatment evidence.

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