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Original Article

Ultrasound-guided stellate ganglion block with ropivacaine for postpartum depression

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Abstract: Objective: To evaluate the efficacy of ultrasound-guided stellate ganglion block (SGB) with ropivacaine in treating postpartum depression. Methods: A retrospective analysis was conducted on the medical records of 98 patients from Ordos Central Hospital, treated between January 2020 and December 2022. Patients were divided into two groups: with 42 patients receiving escitalopram oxalate tablets (escitalopram group) and 56 patients undergoing ultrasound-guided SGB with ropivacaine (ropivacaine group). The therapeutic effects, depression, sleep status, and stress levels before and after treatment were compared. Logistic regression analysis was performed to identify risk factors for postpartum depression recovery. Results: Post-treatment, the Hamilton Depression Rating Scale (HAMD), Edinburgh Postpartum Depression Scale (EPDS), and Pittsburgh Sleep Quality Index (PSQI) scores decreased significantly in both groups, with the ropivacaine group showing greater improvements (all $P < 0.05$). Additionally, the levels of adrenocorticotropic hormone (ACTH), corticotropin-releasing hormone (CRH), and cortisol (Cor) were significantly lower in the ropivacaine group compared to the escitalopram group (all $P < 0.05$). The total effective rate was higher in the ropivacaine group than in the escitalopram group ($P < 0.05$). Logistic multivariate regression identified mode of delivery, household economic status, marital relationship, frequency of exercise during the second trimester, and treatment mode as independent risk factors for postpartum depression recovery (all $P < 0.05$). Conclusion: Ultrasound-guided SGB with ropivacaine is an effective treatment for postpartum depression, significantly alleviating depression symptoms, improving sleep quality, and reducing stress levels. This treatment is recommended for clinical application.

Keywords: Ultrasound, ropivacaine, stellate ganglion block, postpartum depression, efficacy

Introduction

Postpartum depression, also known as postpartum depressive disorder, is a significant mental health condition that develops in the weeks following childbirth [1]. It affects approximately 10% to 15% of new mothers, with 50% to 75% experiencing mild depressive symptoms within the first week post-delivery. Alarmingly, 10% to 15% of these women progress to more severe postpartum depressive disorder [2]. As societal pressures and lifestyles change, concerns are rising that the incidence of postpartum depression may increase in certain populations or regions, underscoring the need for early identification and intervention to protect both maternal and infant health.

Untreated postpartum depression has far-reaching consequences, affecting maternal bonding, child development, and family dynamics. Studies have shown that untreated postpartum depression can result in impaired mother-infant interactions and increase the risk of developmental issues in children. Thus, effective treatment strategies are essential.

While oral antidepressants can provide rapid symptom relief, they may also cause side effects that compromise safety, highlighting the need for alternative treatments that are both effective and safe. One promising option is stellate ganglion block (SGB), a procedure commonly used for post-traumatic stress disorder and schizophrenia [3]. SGB can significantly alleviate symptoms of various mental health conditions by targeting the sympathetic nervous system, offering a novel mechanism for addressing the physiological aspects of postpartum depression. In clinical practice, SGB is

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often performed under ultrasound guidance with the addition of ropivacaine, a local anesthetic known for its efficacy in pain management. Ropivacaine, when applied to the stellate ganglion region, can reduce pain and regulate nerve function [4].

Given the rising incidence of postpartum depression and the limitations of traditional treatments, this study aims to evaluate the clinical efficacy of ultrasound-guided SGB with ropivacaine in treating postpartum depression. Through this innovative approach, we hope to provide valuable insights that could improve clinical practice and outcomes for mothers suffering from this debilitating condition. This research not only addresses a pressing public health issue but also contributes to the growing body of evidence supporting alternative treatments for mental health disorders.

Methods and materials

Case selection

This retrospective study analyzed the medical records of 98 patients treated at Ordos Central Hospital between January 2020 and December 2022. Patients were divided into two groups based on treatment method: there were 42 patients who received escitalopram oxalate tablets which were included in the escitalopram group, and 56 patients who underwent ultrasound-guided SGB with ropivacaine who were included in the ropivacaine group. The study was approved by the Medical Ethics Committee of the Ordos Central Hospital and complied with the Declaration of Helsinki [5].

Inclusion criteria: 1. Confirmed Diagnosis: Patients meeting the established diagnostic criteria for postpartum depression [6]. 2. Absence of Suicidal Tendencies: Patients without evident suicidal ideation or tendencies, ensuring safety throughout the study. 3. No History of Drug Allergies: Patients with no known allergies to ropivacaine or other drugs used in the stellate ganglion block procedure. 4. Complete Clinical Data: Patients with comprehensive and accessible clinical records, including relevant obstetric history, psychiatric assessments, and prior medical history.

Exclusion criteria: 1. Prior Psychiatric Medication Use: Patients who had previously received antidepressants, antipsychotics, or any other psychiatric medications, to avoid confounding effects. 2. Poor Compliance: Patients identified as having low adherence to study procedures, follow-up schedules, or treatment protocols. 3. Severe Organic Brain Disease: Patients with significant organic brain disorders, such as neurodegenerative diseases or traumatic brain injuries, which could interfere with assessment or outcomes. 4. Substance Dependence: Patients with a history of substance dependence, including drug or alcohol use, which could affect treatment response and confound the study results. 5. Other Psychiatric Disorders: Patients with concurrent major psychiatric conditions, such as bipolar disorder or schizophrenia, that may require alternative treatment approaches.

Therapeutic schemes

Escitalopram group: Patients received escitalopram oxalate tablets (Sichuan Kelun Pharmaceutical Co., ltd.), starting with a daily dose of 5 mg, which was subsequently adjusted based on the patient's condition. The maximum daily dose was capped at 15 mg.

Ropivacaine group: Patients underwent ultrasound-guided SGB with ropivacaine. The patient was positioned supine with the head turned to one side. The neck root was disinfected, and color ultrasound (probe frequency: 6-13 MHz) was used to locate the C7 transverse process and identify the C7 nerve root, longus colli muscle, thyroid gland, neck blood vessels, trachea, and esophagus. An in-plane needle was inserted into the front of the longus colli muscle, and 5 mL of 0.2% ropivaine hydrochloride injection (Shijiazhuang No.4 Pharmaceutical Co., Ltd.) was injected. If Horner's syndrome developed within 15 minutes, the block was considered successful. The treatment was administered once daily, alternating between the left and right sides, with each course consisting of 6 sessions. A total of three courses were administered.

Data collection and outcome measures

Before and after treatment, 3 mL of fasting venous blood was collected from each patient in both groups in the morning. The blood was centrifuged at 3500 rpm for 5 minutes, and the

Table 1. Evaluation criteria for clinical efficacy

Efficacy grade	Evaluative criteria
Markedly effective	Clinical symptoms disappeared, and the depression and sleep quality scores decreased by more than 90%.
Effective	Clinical symptoms were alleviated, and the depression and sleep quality scores decreased by 50% to 90%.
Ineffective	Clinical symptoms showed no improvement or worsened, and the depression and sleep quality scores decreased by less than 50%.

Table 2. Comparison of baseline data

Factors	Escitalopram group (n = 42)	Ropivacaine group (n = 56)	χ^2	P
Age (years old)			0.667	0.414
≤ 30	19	30		
> 30	23	26		
Maternal category			0.031	0.860
Primipara	24	31		
Multipara	18	25		
Disease duration (months)			1.531	0.216
≤ 5	21	35		
> 5	21	21		
Nationality			0.990	0.320
Han nationality	31	46		
Minority nationality	11	10		
Educational level			0.033	0.854
Below junior college	15	19		
Junior college and above	27	37		
Place of residence			0.144	0.704
City	30	38		
Rural	12	18		

supernatant was stored at low temperature for subsequent analysis. Serum stress markers, including adrenocorticotropic hormone (ACTH), corticotropin-releasing hormone (CRH), and cortisol (Cor), were measured using enzyme-linked immunosorbent assay (ELISA).

Main outcome measures: The therapeutic effects were compared between the two groups. The total effective rate was calculated as: Total effective rate = (markedly effective + effective) × 100%/total number of patients. Efficacy was evaluated based on the criteria shown in **Table 1**. The Edinburgh Postpartum Depression Scale (EPDS) [7] and the Hamilton Depression Rating Scale (HAMD) [8] were used to assess depression levels before and after treatment in both groups.

EPDS includes 10 items, with a total score ranging from 0 to 30. A score of 12-13 suggests possible postpartum depression, while a score of 13 or higher indicates postpartum depression.

HAMD includes 17 items. A score of 24 or higher indicates severe depression, a score of 17-23 indicates mild to moderate depression, a score of 8-16 suggests possible depression, and a score of 7 or below indicates no depressive symptoms.

Secondary outcome measures: The Pittsburgh Sleep Quality Index (PSQI) [9] was used to assess sleep quality before and after treatment in both groups. The total score ranges from 0 to 21, with higher scores indicating poorer sleep quality. Additionally, serum stress levels (ACTH, CRH, and Cor) were compared between the two groups before and after treatment.

Statistical methods

Statistical analysis was performed using SPSS 20.0 (SPSS Inc., Chicago, IL, USA) and data visualization was carried out with GraphPad Prism 7 (GraphPad Software Co., Ltd., San Diego, USA). Categorical data were expressed as percentages (%) and analyzed using the chi-square test (χ^2). Continuous data were presented as mean ± standard deviation (SD) for normally distributed variables. Paired t-tests were used for intra-group comparisons, while independent sample t-tests were applied for inter-

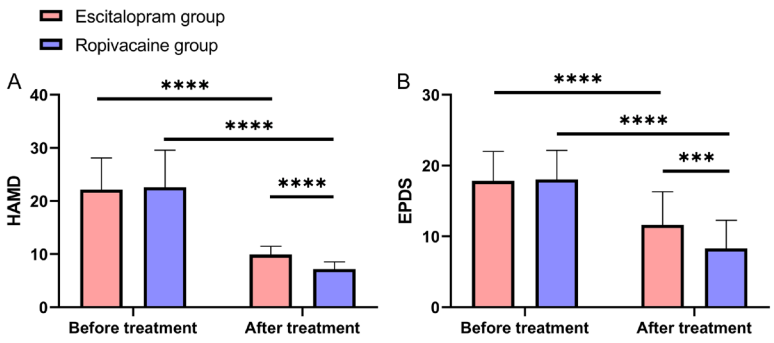

Figure 1. Comparison of depression. A. Changes in HAMD scores before and after treatment. B. Changes of EPDS scores before and after treatment. Note: *** means P < 0.001, **** means P < 0.0001. EPDS, Edinburgh postpartum depression scale; HAMD, Hamilton depression scale.

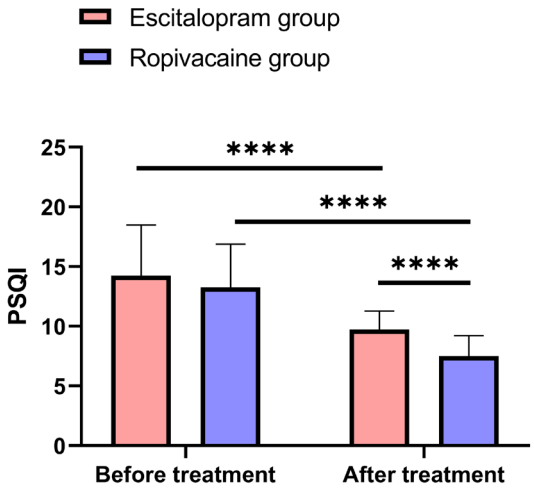

Figure 2. Comparison of sleep quality. Note: **** means P < 0.0001. PSQI, Pittsburgh sleep quality index.

group comparisons. Statistical significance was defined as P < 0.05.

Results

Comparison of baseline data

No significant differences were observed in baseline characteristics, including age, maternal category, disease duration, nationality, educational level, and place of residence, between the two groups (all P > 0.05) (**Table 2**).

Comparison of depression

Before treatment, there were no significant differences in HAMD and EPDS scores between the two groups (both P > 0.05). However, after treatment, the HAMD and EPDS scores were significantly lower in the ropivacaine group compared to the escitalopram group (both P < 0.05). Additionally, intra-group comparisons revealed that both groups had significantly higher HAMD and EPDS scores before treatment compared to after treatment (both P < 0.05) (**Figure 1**).

Comparison of sleep quality

There were no significant differences in PSQI scores between the two groups before treatment (P > 0.05). After treatment, the PSQI score was significantly lower in the ropivacaine group compared to the escitalopram group (P < 0.05). Intra-group comparisons showed that both groups had significantly higher PSQI scores before treatment compared to after treatment (P < 0.05) (**Figure 2**).

Comparison of stress levels

Before treatment, there were no significant differences in ACTH, CRH, or Cor levels between the two groups (all P > 0.05). After treatment, the levels of ACTH, CRH, and Cor were significantly lower in the ropivacaine group compared to the escitalopram group (all P < 0.05). Intra-group comparisons revealed that ACTH, CRH, and Cor levels were significantly higher before treatment compared to after treatment in both groups (all P < 0.05) (**Figure 3**).

Comparison of efficacy

The therapeutic effects were analyzed and compared between the two groups. The results revealed that the total effective rate in the escitalopram group was significantly lower than that in the ropivacaine group (P = 0.045) (**Table 3**).

Risk factors affecting postpartum depression recovery

Patients who showed significant or moderate improvement were assigned to the good prognosis group (n = 81), while those who showed

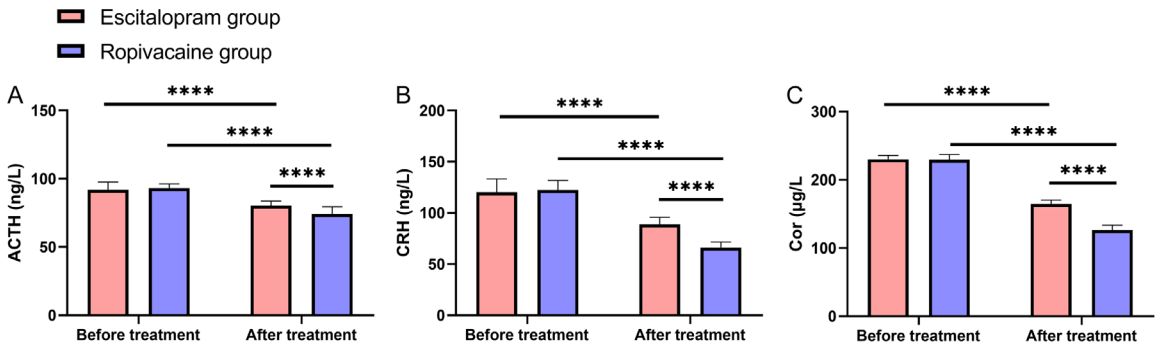

Figure 3. Comparison of stress levels. A. Changes of ACTH level before and after treatment. B. Changes of CRH level before and after treatment. C. Changes of Cor levels before and after treatment. Note: **** means P < 0.0001. ACTH, Adrenocorticotrophic hormone; CRH, Corticotropin releasing hormone; Cor, Cortisol.

Table 3. Comparison of therapeutic effect

Groups	Markedly effective	Effective	Ineffective	Total effective rate
Escitalopram group (n = 42)	13 (30.95)	18 (42.86)	11 (26.19)	31 (73.81)
Ropivacaine group (n = 56)	23 (41.07)	27 (48.21)	6 (10.71)	50 (89.29)
χ^2				4.009
P				0.045

no improvement were placed in the poor prognosis group (n = 17). Univariate analysis identified several risk factors affecting postpartum depression recovery, including maternal category, mode of delivery, household economic status, marital relationship, frequency of exercise during the second trimester, and treatment modality (**Table 4**). These significant factors were then assigned values for multivariate regression analysis, the details of which are provided in **Table 5**. Logistic multivariate regression analysis identified mode of delivery, household economic status, marital relationship, frequency of exercise during the second trimester, and treatment modality as independent risk factors for postpartum depression recovery (**Table 6**).

Discussion

Women commonly experience emotional fluctuations after childbirth, ranging from joy and satisfaction to feelings of anxiety and uneasiness. For some, these emotional changes can evolve into postpartum blues or depression, a prevalent mental health issue influenced by multiple factors [10]. Hormonal fluctuations during and after pregnancy significantly affect a woman's emotional state, and additional factors such as physical fatigue, life stressors, or unmet pregnancy expectations can exacerbate depressive symptoms [11-13].

SGB therapy is used to treat certain conditions by intervening in nerve transmission and regulation through blocking the activity of the stellate ganglion, thereby achieving therapeutic effects [14, 15]. Ropivacaine, when combined with SGB, produces an anesthetic effect by inhibiting nerve conduction. In this study, the combination of SGB with ropivacaine was evaluated for its potential to improve both depressive symptoms and sleep quality in postpartum patients. This therapy shows promise, as it avoids the systemic side effects associated with certain antidepressants, potentially offering a safer and more tolerable treatment option.

The results demonstrated that HAMD, EPDS, and PSQI scores were significantly reduced in both groups after treatment, with greater improvement observed in the ropivacaine group compared to the escitalopram group. This suggests that SGB with ropivacaine may offer dual benefits, improving both mood and sleep quality. The mechanism behind this could be that SGB with ropivacaine alleviates depressive symptoms while minimally disrupting sleep, thereby improving overall sleep quality. This finding is consistent with research by Mulvaney

Table 4. Univariate analysis

Factors	Poor prognosis group (n = 17)	Good prognosis group (n = 81)	χ^2	P
Age (years old)			0.641	0.424
≤ 30	7	42		
> 30	10	39		
Maternal category			5.747	0.017
Primipara	14	41		
Multipara	3	40		
Course of disease (months)			0.854	0.355
≤ 5	8	48		
> 5	9	33		
Nation			1.141	0.286
Han nationality	15	62		
Minority nationality	2	19		
Educational level			0.253	0.615
Below junior college	5	29		
Junior college and above	12	52		
Place of residence			0.014	0.906
City	12	56		
Rural	5	25		
Mode of delivery			8.177	0.004
Natural delivery	6	58		
Non-natural delivery	11	23		
Household economic status			5.825	0.016
Good	6	54		
Poor	11	27		
Marital relationship			4.828	0.028
Good	8	60		
Poor	9	21		
Frequency of exercise during the second trimester (times/week)			5.487	0.019
≤ 3	12	32		
> 3	5	49		
Treatment mode			12.31	0.001
Escitalopram	13	25		
Ultrasound-guided SGB with ropivacaine	4	56		

Table 5. Assignment

Factors	Assignment
Maternal category	Primipara = 0, Multipara = 1
Mode of delivery	Natural delivery = 0, Non-natural delivery = 1
Household economic status	Good = 0, Poor = 1
Marital relationship	Good = 0, Poor = 1
Frequency of exercise during the second trimester (times/week)	> 3 = 0, ≤ 3 = 1
Treatment mode	Ultrasound-guided SGB with ropivacaine = 0, Escitalopram oxalate = 1
Prognosis	Good = 0, Poor = 1

SGB, stellate ganglion block.

Table 6. Multivariate analysis

	B	S.E.	Wals	Sig.	Exp (B)	EXP (B) for 95% C.I.	
Maternal category	-1.609	0.846	3.617	0.057	0.200	0.038	1.050
Mode of delivery	2.524	0.953	7.015	0.008	12.481	1.928	80.815
Household economic status	2.711	0.997	7.396	0.007	15.051	2.132	106.231
Marital relationship	2.632	1.079	5.955	0.015	13.906	1.679	115.179
Frequency of exercise during the second trimester	2.580	1.068	5.842	0.016	13.201	1.629	106.979
Treatment mode	2.955	0.977	9.146	0.002	19.203	2.829	130.349

et al. [16], which demonstrated the efficacy of SGB in reducing anxiety symptoms in patients with post-traumatic stress disorder. The ability of SGB with ropivacaine to provide stable relief while alleviating depressive symptoms suggests it may serve as a valuable alternative for postpartum patients who are sensitive to the side effects of conventional antidepressants.

Further analysis focused on changes in the neuroendocrine markers CRH, ACTH, and Cor, which are central to the body's stress response and often elevated in depression [17-19]. After treatment, reductions in ACTH, CRH, and Cor levels were observed in both groups, with the SGB and ropivacaine group showing significantly lower levels than the escitalopram group. This suggests that SGB with ropivacaine can attenuate the stress response, likely contributing to its antidepressant effects. Similar findings were reported by Zhu et al., who observed that SGB decreased the stress response in patients undergoing laparoscopic colorectal cancer surgery, thereby promoting gastrointestinal recovery [20].

Finally, the efficacy of the treatments was analyzed and compared. The results revealed that the total effective rate in the escitalopram group was significantly lower than in the ropivacaine group. The current study demonstrates that ultrasound-guided SGB with ropivacaine is highly effective in treating postpartum depression, offering greater improvements in mood and sleep quality compared to escitalopram. This intervention may become a promising option in clinical practice for managing postpartum depression, particularly for patients who are sensitive to conventional antidepressants.

This study highlights the significant efficacy of ultrasound-guided SGB with ropivacaine in treating postpartum depression. However, it is not without limitations. As a retrospective study with a relatively small sample size, the results may be subject to bias. Future research with larger sample sizes and prospective designs is needed to further validate these findings and assess the long-term efficacy and safety of SGB with ropivacaine in treating postpartum depression.

In conclusion, ultrasound-guided SGB with ropivacaine has been shown to effectively treat postpartum depression by relieving depressive symptoms, improving sleep quality, and reducing stress levels. Therefore, this treatment regimen holds promise for clinical application and wider adoption in managing postpartum depression.

Disclosure of conflict of interest

None.

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