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Effect of Relaxation Exercise Training Combined With a Refined Nursing on Pregnancy Outcomes in Patients With Gestational Hypertension Complicated by Anxiety and Depression

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Abstract

Background: Gestational hypertension frequently leads to anxiety and depression, which conventional nursing inadequately addresses.

Methods: This retrospective study compared 150 patients with gestational hypertension and comorbid anxiety disorder or depressive disorder (diagnosed according to Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition criteria): a control group (n = 68, routine care) and an observation group (n = 82, routine care plus refined nursing and relaxation exercise training). The study evaluated Hamilton Anxiety Rating Scale (HAMA) and Hamilton Depression Rating Scale (HAMD) scores (used to assess the severity of emotional states), blood pressure control, and pregnancy outcomes.

Results: At 4 and 8 weeks, both groups showed significant reductions in HAMA, HAMD, systolic and diastolic blood pressures versus pre-treatment. The observation group demonstrated greater improvement in all these measures ($p < 0.05$). For pregnancy outcomes, the observation group had higher Apgar scores compared to the control group ($p < 0.05$).

Conclusions: The combined treatment effectively alleviated anxiety and depression, enhanced blood pressure

control, and optimized pregnancy outcomes, thereby safeguarding maternal-infant safety and demonstrating significant clinical value.

Keywords

gestational hypertension; anxiety; depression; relaxation exercise training; nursing care

Introduction

Gestational hypertension is a common complication specific to pregnancy, typically occurring after 20 weeks of gestation. Characterized primarily by elevated blood pressure, without proteinuria, and possibly accompanied by edema. In severe cases, it can lead to life-threatening conditions like preeclampsia and eclampsia, posing significant risks to both maternal and fetal health [1,2]. In recent years, advances in perinatal medicine have progressively improved clinical diagnosis and treatment of gestational hypertension. However, the physiological discomfort and inherent risks associated with the condition continue to predispose patients to adverse emotional states such as anxiety and depression [3]. These psychological issues not only affect patients' sleep quality, dietary habits, and treatment adherence but may also indirectly influence the pregnancy process through neuro-endocrine-immune regulatory networks. This increases the risk of adverse pregnancy outcomes such as preterm birth, fetal growth restriction, and placental abruption, creating a vicious cycle of physiological disease → psychological abnormalities → adverse outcomes [4].

Current clinical care models for hypertensive pregnant women primarily focus on routine physiological monitoring (including blood pressure, fetal heart rate, and urine

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protein levels), medication guidance, and basic dietary and rest recommendations [5]. This model centers on controlling physiological indicators of the disease, which can delay progression to some extent. However, it has significant limitations in service dimensions: it lacks systematic attention to patients' psychological needs, lacks standardized mechanisms for emotional support, and struggles to alleviate anxiety and depression at their root. Furthermore, pregnant women inherently face challenges such as increased physical demands and physiological changes. Traditional care predominantly relies on standardized guidance and passive information delivery, lacking personalized approaches to physical and mental adjustment. This results in patients adopting a passive stance toward disease management, with insufficient cultivation of self-management awareness and health coping abilities [6]. Therefore, breaking free from the limitations of traditional, one-size-fits-all care and constructing an integrated nursing plan that encompasses physiological care, psychological treatment, and proactive rehabilitation has become a key direction for improving the quality of care and prognosis for patients with gestational hypertension. Refined nursing plans, characterized by individualization, accuracy, and comprehensiveness, meticulously deconstruct nursing processes and deeply focus on individual differences. This enables the provision of multidimensional, high-quality care services encompassing dynamic condition monitoring, personalized lifestyle guidance, and targeted psychological support. Such individualized multidimensional care makes up for the one-size-fits-all defects of routine prenatal care, and clinical trials have confirmed that integrated nursing strategies can effectively relieve negative emotions and stabilize blood pressure among women with hypertensive disorders of pregnancy [7]. Relaxation exercise training, as a safe, non-invasive, and easily accessible method for mind-body regulation, employs specific techniques such as breath control, muscle contraction-relaxation training, and meditation. It helps individuals alleviate physical tension and reduce sympathetic nervous system excitability, demonstrating clear application value in emotional regulation and physiological relaxation [8]. Integrating refined nursing protocols with relaxation exercise training holds promise for establishing a comprehensive treatment model encompassing physiological care, psychological treatment, and active rehabilitation. This approach aims to achieve synergistic effects in standardized disease management and psychophysical state regulation.

Based on this rationale, the present study investigates the impact of combining refined nursing protocols with relaxation exercise training on anxiety/depression levels and pregnancy outcomes among patients with gestational hy-

pertension. By developing a scientific, systematic, comprehensive treatment strategy, to observe changes in anxiety and depression scores, blood pressure control, and pregnancy outcome indicators before and after treatment. This study aims to clarify the clinical value of this treatment model, provide new insights and references for nursing practices in pregnant women with hypertension, and ultimately enhance perinatal care quality to ensure maternal and infant safety.

Materials and Methods

Study Population

This retrospective study extracted data from medical records and included 150 patients diagnosed with gestational hypertension who were treated at the Obstetrics and Gynecology Department of Huzhou Maternal & Child Health Care Hospital between June 2021 and June 2024.

Inclusion criteria: (1) Meet the diagnostic criteria for gestational hypertension [9], i.e., first occurrence after 20 weeks of gestation of systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg, without proteinuria or manifestations of preeclampsia; (2) Singleton pregnancy; (3) Gestational age between 20 and 34 weeks; (4) They were diagnosed with anxiety disorder or depressive disorder by a professional psychiatrist according to the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) [10], with clear medical records. The Hamilton Anxiety Rating Scale (HAMA) and Hamilton Depression Rating Scale (HAMD) scales were used only as tools to assess severity and were not used as the basis for diagnosing mental disorders; (5) Voluntary participation with signed informed consent (retrospective data collection supplemented with informed consent procedures).

Exclusion Criteria: (1) Concurrent other pregnancy complications (e.g., gestational diabetes, placenta previa) or severe cardiac, hepatic, renal, or other organ diseases; (2) History of psychiatric disorders or family history of psychiatric disorders; (3) Contraindications to exercise (e.g., severe osteoporosis, lumbar spine disorders); (4) Use of anxiolytic, antidepressant, or other mood-altering medications during pregnancy; (5) Incomplete clinical data or inability to complete follow-up for relevant indicators. (6) Those with combined proteinuria, preeclampsia, and eclampsia.

This retrospective chart review study involving human participants was in accordance with the ethical standards of the institutional and national research committee and with

the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The Human Investigation Committee (IRB) of Huzhou Maternal & Child Health Care Hospital [Approval number: 2026-J-023]. Written informed consent was obtained from all participants and their legal guardians.

Grouping Method

Patients were retrospectively grouped based on the actual treatment received: 68 patients receiving routine nursing care were assigned to the control group, while 82 patients receiving routine nursing care supplemented with a refined nursing plan combined with relaxation exercise training were assigned to the observation group.

Treatment Methods

Refined Nursing (Precision Nursing): Individualized multi-dimensional care including dynamic condition monitoring, targeted psychological intervention, personalized diet and sleep guidance, and family support participation.

Comprehensive Intervention Model: A combined intervention protocol integrating routine nursing + refined nursing + relaxation training.

Treatment Period: The treatment measures were continuously implemented from enrollment until delivery. The core observation period was a total of 8 weeks of treatment, and subsequent follow-ups continued until delivery to observe pregnancy outcomes.

All treatments in this study were nursing treatments and psycho-behavioral treatments. They did not include psychiatric medication, physical therapy, or other specialized psychiatric treatment methods. All procedures were performed by professional obstetric nurses and rehabilitation therapists under the guidance of psychiatrists. Routine nursing treatments included: (1) Condition Monitoring: Regularly measure the patient's blood pressure and heart rate, monitor fetal heart rate and fetal movements, conduct periodic follow-up tests such as urinalysis and liver/kidney function assessments, promptly identify abnormalities, and report them to the physician for management. (2) Basic Care: Guide patients on appropriate dietary habits, ensuring low-salt, low-fat, high-protein, and high-vitamin intake while controlling weight gain rate; Ensure adequate sleep, with no less than 8 hours daily, primarily in the left lateral position. Maintain a quiet, clean ward environment with regular ventilation and disinfection. (3) Medication Guidance: For patients requiring medication, thor-

oughly explain drug names, dosages, administration methods, mechanisms of action, and potential adverse reactions. Instruct patients to take medications on time and at the prescribed dose, avoiding self-adjustments or discontinuation. (4) Health Education: Utilize verbal explanations and informational brochures to educate patients about pregnancy-induced hypertension, including its causes, clinical manifestations, treatment methods, prognosis, and precautions, thereby enhancing disease awareness.

Refined Nursing Specific Measures: (1) Personalized Assessment and Plan Development: Upon enrollment, the assigned nurse conducted a comprehensive assessment of the patient's physical condition, psychological state, family support system, cultural background, and cognitive level. Based on the patient's specific circumstances, a personalized, detailed care plan was developed and dynamically adjusted according to changes in the patient's condition and psychological state. (2) Detailed Condition Monitoring: Use electronic sphygmomanometers to monitor blood pressure at scheduled intervals, four times daily (upon waking, mid-morning, mid-afternoon, and bedtime). Take three readings per session, spaced five minutes apart, recording the average value. Closely observe for abnormal symptoms such as headache, dizziness, blurred vision, or worsening lower limb edema; notify physicians immediately upon detection. Conduct weekly follow-up tests for urinalysis and blood biochemistry indicators to dynamically monitor disease progression. (3) Targeted Psychological Treatment: Engage in daily communication with the patient for 15–20 minutes, patiently listening to their concerns and providing emotional support and reassurance. Guide the patient to express inner feelings to alleviate negative emotions. Address misunderstandings and fears about the disease using plain language to correct misconceptions and help establish accurate disease awareness and treatment confidence. Communicate with family members, encouraging them to provide companionship, care, emotional support, and daily assistance to foster a warm, harmonious home environment that reduces psychological stress. (4) Detailed Lifestyle Guidance: Collaborate with nutritionists to develop personalized dietary plans based on the patient's weight, gestational age, blood pressure, and eating habits. Specify daily intake limits for salt, protein, fat, and calories. Guide patients to consume more fresh vegetables, fruits, whole grains, and other fiber-rich foods while avoiding spicy, greasy, or irritating foods. Develop structured sleep schedules aligned with patients' routines, advising against stimulating activities like phone use or TV before bed. Promote sleep quality through calming music or warm foot soaks. Guide patients in moderate daily activities (e.g., walking) based on physical condition, avoiding strenuous exercise or prolonged bed rest to

enhance blood circulation.

Relaxation Exercise Training Specific Measures: (1) **Pre-training Preparation:** A professional rehabilitation therapist conducted a pre-exercise assessment to confirm no contraindications. The purpose, methods, precautions, and key points of cooperation for relaxation exercises were explained to ensure the patient mastered the correct training approach. (2) **Training Content:** **Breathing relaxation training:** Patients assumed a comfortable supine or seated position, relaxed the entire body, closed their eyes, inhaled slowly through the nose for 4–6 seconds (feeling the abdomen rise), paused for 2–3 seconds, then exhaled slowly through the mouth for 6–8 seconds (feeling the abdomen fall). Repeat for 10–15 minutes, twice daily (upon waking and before bed). **Muscle Relaxation Training:** Starting from the feet, sequentially contract and relax muscles in the calves, thighs, buttocks, abdomen, chest, upper limbs, neck, and face. Hold each contraction for 5–10 seconds, followed by 15–20 seconds of relaxation. Gradually progress to full-body muscle relaxation. Each session lasted 15–20 minutes and was performed once daily (afternoon). **Meditation training:** The patient assumed a comfortable position, relaxed the entire body, and focused on their own breathing or a simple word/image, eliminating distracting thoughts. Meditate for 10–15 minutes, once daily (before bedtime). (3) **Training Precautions:** The responsible nurse must accompany the patient throughout the training session, closely monitoring changes in complexion, breathing, heart rate, and blood pressure. If symptoms such as dizziness, palpitations, or chest tightness occur, immediately stop the training and take appropriate measures. Gradually adjust the training intensity and duration based on the patient's physical condition and tolerance level to avoid overexertion.

Observation Indicators

(1) **Anxiety and Depression Scores:** The HAMA [11] and HAMD [12,13] scores were extracted for each patient group. The HAMD-17 scale consists of 17 items and uses a mixed scoring method ranging from 0 to 4 points and 0 to 2 points. The total score ranges from 0 to 52 points, with higher scores indicating more severe depressive symptoms.

(2) **Blood Pressure Control:** Systolic and diastolic blood pressure monitoring data were collected for both groups before treatment, at 4 weeks post-treatment, and at 8 weeks post-treatment. The rate of achieving blood pressure control targets was calculated (defined as systolic < 140 mmHg and diastolic < 90 mmHg).

(3) **Pregnancy Outcome Indicators:** Record the neonatal

Apgar score (at 1 minute postpartum) for both groups.

Newborn Apgar Score [14]: The Apgar score was used to comprehensively evaluate the vital signs and the degree of asphyxia of newborns one minute after delivery. It comprised five indicators: heart rate, respiratory effort, muscle tone, reflex irritability, and skin color. Each indicator was scored from 0 to 2, with a total score ranging from 0 to 10.

Data Collection and Statistical Methods

A designated staff member retrieved, sorted, and verified all observational data by reviewing hospital electronic medical records, nursing documentation, and follow-up materials to ensure accuracy and completeness. Data were processed using SPSS version 22.0 statistical software (IBM Corp., Armonk, NY, USA). The Shapiro-Wilk test was used to test for normality. Normally distributed continuous variables were expressed as mean $\pm$ standard deviation ($\bar{x} \pm SD$). Continuous variables with non-normal distribution were expressed as median (interquartile range, 25th percentile, 75th percentile) and analyzed using the Mann-Whitney U test. Repeated-measures analysis of variance (ANOVA) was used to analyze the between-group effects, time effects, and group $\times$ time interaction effects for repeated measures, including systolic blood pressure, diastolic blood pressure, HAMA scores, and HAMD scores. The assumptions of normality and sphericity were verified before analysis. Missing data were handled using complete case analysis. Bonferroni correction was applied for multiple comparisons to control type I errors. Exact p values, effect sizes were reported for all primary outcome measures. Categorical variables were presented as frequency and percentage (%). Between-group comparisons for categorical variables were conducted using chi-square tests. A two-tailed test with $p < 0.05$ was considered statistically significant. For categorical repeated measures such as blood pressure control rate, the main effect of time and group-time interaction effect were analyzed using Cochran's Q test combined with generalized estimating equations (GEE).

Results

Comparison of Baseline Characteristics Between the Two Groups

The baseline characteristics between the two groups were compared, and the results are shown in Table 1. There were no statistically significant differences between the two groups in terms of age, gestational week, education level,

Table 1. Comparison of baseline data between the two groups.

Indicator	Control group (n = 68)	Observation group (n = 82)	t/χ^2 value	p value
Age (years)	28.46 ± 3.17	29.03 ± 3.48	0.89	0.374
Gestational week (weeks)	26.74 ± 2.36	27.18 ± 2.29	0.97	0.331
Education level (n, %)			1.12	0.572
Middle school or below	12 (17.65)	15 (18.29)		
High school/Technical secondary school	28 (41.18)	32 (39.02)		
College degree or above	28 (41.18)	35 (42.68)		
Systolic blood pressure (mmHg)	152.64 ± 8.43	153.32 ± 8.31	0.47	0.639
Diastolic blood pressure (mmHg)	95.82 ± 5.74	96.43 ± 5.62	0.64	0.521

systolic blood pressure, or diastolic blood pressure ($p > 0.05$), indicating good comparability between the groups. As this was a retrospective non-randomized study, selection bias may exist; differences in motivation, socioeconomic status, and healthcare-seeking behavior cannot be completely ruled out, and no multivariate adjustment or propensity score matching was performed.

Comparison of HAMA and HAMD Scores (Emotional Severity) Before and After Treatment in Both Groups

Before treatment, HAMA and HAMD scores showed no statistically significant differences between groups ($p > 0.05$). After 4 weeks and 8 weeks of treatment, both groups exhibited significant reductions in these scores compared to baseline, with greater reductions in the observation group than the control group ($p < 0.05$). The 2×3 mixed-design ANOVA results showed that the main effect of group, main effect of time, and group $\times$ time interaction effect were all statistically significant for both HAMA and HAMD scores (Main effect $p < 0.001$, interaction effect $p < 0.01$, both statistically significant) (Table 2).

Comparison of Blood Pressure and Blood Pressure Control Rates Before and After Treatment in Both Groups

Before treatment, there were no statistically significant differences between the two groups in systolic blood pressure, diastolic blood pressure, or blood pressure control rate ($p > 0.05$). After 4 and 8 weeks of treatment, both groups showed significant reductions in systolic and diastolic blood pressure compared to baseline, as well as a significant improvement in blood pressure control rate ($p < 0.05$). The observation group demonstrated greater improvement in these indicators than the control group ($p < 0.05$). For systolic and diastolic blood pressures, a 2×3 mixed-design ANOVA revealed that the main effects of group and time, as well as the group $\times$ time interaction, were all statistically significant. Specifically, the main ef-

fect of group was $p < 0.001$ for both systolic and diastolic blood pressures; the main effect of time was $p < 0.001$ for both; and the group $\times$ time interaction was $p = 0.021$ for systolic blood pressure and $p = 0.026$ for diastolic blood pressure. For the blood pressure control rate (a categorical repeated measure), GEE and Cochran's Q test showed that the main effect of group was $p = 0.003$, the main effect of time was $p < 0.001$, and the group $\times$ time interaction was $p = 0.013$ (Table 3).

Comparison of Pregnancy Outcomes Between Groups

The newborn Apgar score was evaluated at 1 minute after delivery, with only one time point of data available, so an independent samples t -test was used for between-group comparison. The results showed that the Apgar score in the observation group was significantly higher than that in the control group, with a statistically significant difference between the two groups ($t = 7.86$, $p < 0.001$) (Table 4).

Discussion

As a severe complication unique to pregnancy, gestational hypertension not only poses a direct threat to the physiological health of pregnant women but also triggers adverse emotions such as anxiety and depression. These emotions can easily form a vicious cycle of physiological pathology and psychological abnormalities, ultimately affecting pregnancy outcomes. Therefore, clinical care must address both the control of physiological indicators and the regulation of physical and mental states [15,16]. This study developed a comprehensive treatment model combining "detailed care protocols with relaxation exercise training" to deliver personalized treatments tailored to the pathological characteristics and psychological needs of patients with gestational hypertension, achieving significant outcomes. Its core mechanisms of action and clinical value can be analyzed from the following perspectives.

Table 2. Comparison of HAMA and HAMD scores before and after treatment in two patient groups.

Indicator	Group	Before treatment	After 4 weeks of treatment	After 8 weeks of treatment	Effect (2 × 3 mixed-design ANOVA)	F-value	p value
HAMA score	Control group (n = 68)	21.73 ± 3.56	17.52 ± 3.24*	14.15 ± 2.93 [#]	Main effect of group	37.52	<0.001
	Observation group (n = 82)	22.31 ± 3.72	14.36 ± 2.85*	9.94 ± 2.47 [#]	Main effect of time	289.41	<0.001
	t-value	0.92	6.71**	9.86**	Group × Time interaction	6.82	0.009
HAMD score	Control group (n = 68)	27.15 ± 4.32	21.63 ± 3.81*	16.84 ± 3.35 [#]	Main effect of group	41.26	<0.001
	Observation group (n = 82)	27.53 ± 4.41	17.38 ± 3.46*	11.87 ± 2.83 [#]	Main effect of time	326.77	<0.001
	t-value	0.53	7.02**	9.12**	Group × Time interaction	7.15	0.007

Note: Independent samples *t*-tests were used for between-group comparisons at each time point. Paired comparisons showed that the scores at week 4 and week 8 were significantly lower than those before treatment, and the scores at week 8 were significantly lower than those at week 4 (all $p < 0.05$); * $p < 0.05$ compared with before treatment; [#] $p < 0.05$ compared with week 4; ** $p < 0.05$ for between-group comparisons at the same time point; F-value: 2 × 3 mixed-design ANOVA; *t*-value: independent samples *t*-test between groups. HAMA, Hamilton Anxiety Rating Scale; HAMD, Hamilton Depression Rating Scale; ANOVA, analysis of variance.

Table 3. Comparison of blood pressure levels and blood pressure control rates before and after treatment in two patient groups.

Indicator	Group	Before treatment	After 4 weeks of treatment	After 8 weeks of treatment	Effect (2 × 3 mixed-design ANOVA)	F/χ ² value	p value
Systolic blood pressure (mmHg)	Control group (n = 68)	152.64 ± 8.43	142.81 ± 7.75*	137.13 ± 6.62 [#]	Main effect of group	18.39	<0.001
	Observation group (n = 82)	153.32 ± 8.31	137.94 ± 7.46*	132.25 ± 6.14 [#]	Main effect of time	217.53	<0.001
	<i>t</i>	0.47	3.61**	4.52**	Group × Time interaction	5.28	0.021
Diastolic blood pressure (mmHg)	Control group (n = 68)	95.82 ± 5.74	89.53 ± 5.12*	85.61 ± 4.53 [#]	Main effect of group	26.74	<0.001
	Observation group (n = 82)	96.43 ± 5.62	85.37 ± 4.75*	80.92 ± 4.26 [#]	Main effect of time	152.68	<0.001
	<i>t</i>	0.64	5.02**	6.37**	Group × Time interaction	4.91	0.026
Blood pressure control rate (n, %)	Control group (n = 68)	7 (10.29)	31 (45.59)*	52 (76.47) [#]	Main effect of group	8.94	0.003
	Observation group (n = 82)	10 (12.20)	54 (65.85)*	77 (93.90) [#]	Main effect of time	120.35	<0.001
	χ ²	0.12	6.17**	8.94**	Group × Time interaction	6.17	0.013

Note: *Compared with before treatment, $p < 0.05$; [#]Compared with our group after 4 weeks of treatment, $p < 0.05$; **Comparison between groups at the same time point, $p < 0.05$ (independent sample *t*-test was used for systolic and diastolic blood pressure); The blood pressure control rate was tested using the chi-square test. For the blood pressure control rate (categorical repeated measures). The chi-square values in the table correspond to the above test results; ANOVA, analysis of variance.

Table 4. Comparison of Apgar scores between two groups of newborns.

Pregnancy outcome indicator	Control group (n = 68)	Observation group (n = 82)	<i>t</i> /χ ² value	p value
Newborn Apgar score (points)	8.13 ± 0.72	9.02 ± 0.54	7.86	<0.001

Note: An independent sample *t*-test was used for between-group comparison; *t*-value: independent samples *t*-test between groups.

In terms of the effect on emotional regulation, the observation group showed a significantly greater reduction in HAMA and HAMD scores (severity of emotions) after the treatment compared to the control group, which indicated that the comprehensive treatment model had a significant advantage in alleviating the severity of anxiety and depressive disorders [17]. While routine care can educate patients about disease-related knowledge through health promotion, it lacks targeted psychological treatments and emotional guidance methods, making it difficult to fundamentally alleviate patients' concerns about disease progression and fetal safety. Refined nursing, featuring 15–20 minutes of personalized communication daily, provides patients with a channel to express their inner needs. Through emotional support, cognitive restructuring, and the integration of family support systems, it effectively reduces psychological stress. Combined with relaxation exercises—including breathing techniques, muscle relaxation, and meditation—this approach directly reduces sympathetic nervous system excitability and eases physical tension. This breaks the vicious cycle of anxiety-induced blood pressure elevation, achieving synergistic improvement in both emotional state and blood pressure. This dual regulation of psychological treatment and physiological relaxation aligns better with the physical and mental characteristics of pregnant women, providing patients with effective tools for actively coping with negative emotions. Regarding blood pressure control, the observation group demonstrated significantly superior systolic and diastolic blood pressure levels and blood pressure control rate compared to the control group after 4 and 8 weeks of treatment, confirming the precision and efficacy of the comprehensive treatment model in disease management. Conventional nursing typically involves periodic routine blood pressure monitoring, with dietary and lifestyle guidance lacking individualized adaptation. This approach struggles to fully address the diverse needs arising from differences in disease severity and lifestyle habits among patients. Refined nursing, through four daily blood pressure measurements (each taken three times), dynamically captures blood pressure fluctuation patterns, providing a basis for timely adjustments to care plans. Combined with personalized dietary plans developed by nutritionists, it precisely controls salt and fat intake, overcoming the limitations of generalized dietary advice. Relaxation exercise training, by improving vascular elasticity and regulating autonomic nervous function, provides auxiliary support for blood pressure control. This synergistic effect with refined nursing significantly enhances the stability and achievement rate of blood pressure control [18,19]. Differences in pregnancy outcomes further underscore the clinical significance of comprehensive treatments. The observation group exhibited superior Apgar scores—outcomes closely linked

to improved emotional regulation and blood pressure control. Persistent anxiety and depression during pregnancy can affect placental blood supply through neuroendocrine-immune regulatory networks, increasing risks of preterm birth and fetal distress. Poor blood pressure control may lead to intrauterine growth restriction, impacting neonatal health [20]. Comprehensive treatments effectively alleviate negative emotions and stabilize blood pressure, creating favorable conditions for normal fetal growth and development. Simultaneously, targeted delivery preparation guidance and recommendations for moderate physical activity during pregnancy within refined care enhance patients' tolerance for labor and increase the likelihood of vaginal delivery. In contrast, routine care lacks systematic treatment targeting risk factors associated with pregnancy outcomes, making it difficult to ensure maternal and infant safety from multiple dimensions [21,22].

This research has several notable limitations that should be acknowledged. First, this was a single-center retrospective observational study without random grouping, which may introduce inherent selection bias. Confounding factors including patients' self-motivation for treatment, individual compliance with nursing interventions and socioeconomic differences could not be fully eliminated, and multivariate adjustment or propensity score matching was not performed to balance baseline confounding variables. Second, we did not systematically record participants' treatment compliance data, conduct standardized assessment of intervention fidelity, or quantitatively grade the intensity of relaxation exercise training, which may reduce the reproducibility and generalizability of the integrated nursing protocol. Third, patients with personal or family psychiatric history were excluded per eligibility criteria, restricting the sample to mild first-onset anxiety and depression among gestational hypertension patients; the findings may not be applicable to patients with severe or recurrent mood disorders. Finally, only short-term indicators including anxiety-depression scales, blood pressure control and neonatal 1-minute Apgar scores were observed, without long-term follow-up of maternal postpartum mental status and long-term cardiovascular outcomes. Future large-sample, multi-center prospective randomized controlled trials are required to further verify the sustained efficacy of this combined intervention model. Stratified subgroup analyses based on maternal age, gestational week and severity of hypertension are also warranted to develop targeted individualized intervention schemes for diverse patient populations.

Conclusions

The integrated approach combining refined nursing with relaxation exercise training constituted an effective treatment model for improving outcomes in patients with gestational hypertension. This model was grounded in personalized, refined nursing care. Through comprehensive assessment and dynamically adjusted condition monitoring, targeted psychological treatments, and individualized lifestyle guidance, it addressed the limitations of conventional nursing care. Coupled with safe, non-invasive breathing relaxation, muscle relaxation, and meditation training, it achieved synergistic effects between physiological care, psychological regulation, and active rehabilitation. This approach not only significantly reduces HAMA and HAMD scores and improves blood pressure control, but also increases the blood pressure control rate. In addition, this method is associated with improved Apgar scores, which may provide some assurance of maternal and neonatal safety. Considering the retrospective design of this study and potential confounding factors, this approach demonstrates potential clinical value, may be considered in clinical practice, and offers a reference direction for the nursing management of gestational hypertension.

Availability of Data and Materials

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author Contributions

FFZ, YLS and FQ designed the research study. FFZ, YLS and FQ performed the research. FFZ drafted the manuscript. All authors contributed to editorial changes and critical revision. All authors read and approved the final manuscript. All authors agree to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

This retrospective chart review study involving human participants was in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The Human Investigation Committee (IRB) of Huzhou Maternal & Child Health Care Hospital [Approval number: 2026-J-023]. Written informed consent was obtained from all participants and their

legal guardians.

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Conflict of Interest

The authors declare no conflict of interest.

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