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Advances in Obstetrics and Gynecology Research

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Prevention of Gestational Hypertension Complicated with Heart Failure

Hongjie Li†, Yuanyuan Li†, Peng Sun*, Mengdie Xie*, Huiping Tian, Jin Song, Xinrong Zhang, Ling Yin, Kai Wang, Ning Zhang, Danhua Xu

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Abstract: *Objective:* To explore effective preventive measures for gestational hypertension complicated with heart failure. *Method:* 23 patients with gestational hypertension complicated with heart failure who underwent prenatal examination and delivery in our hospital from January 2022 to January 2023 were selected. Provide routine prenatal care and treatment for these patients, and implement comprehensive prevention and intervention measures on this basis. Compare the incidence of heart failure, maternal and infant outcomes, and related clinical indicators between two groups of patients. *Result:* All 23 patients were successfully rescued. *Conclusion:* Implementing comprehensive prevention and intervention measures for patients with gestational hypertension can effectively reduce the incidence of heart failure, improve maternal and infant outcomes, and has important clinical application value.

Keywords: Pregnancy period; Hypertension disease; Heart failure; Prevention

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1. Introduction

Gestational hypertension is a pregnancy specific disease that poses a significant threat to the health of both mother and baby. The progression of its condition can lead to impaired cardiac function, concurrent heart failure, and increased maternal and neonatal mortality rates^[1]. Therefore, actively exploring effective preventive measures is of great significance for improving the prognosis of patients with gestational hypertension. By comparing the preventive effects of different prevention strategies on gestational hypertension complicated with heart failure, this study provides reference for clinical practice. The current research report is as follows.

2. Data and method

2.1. Research object

23 patients were selected, in which they were diagnosed with gestational hypertension during prenatal examination in the hospital from January 2022 to January 2023, aged 22 to 41 years old with an average of 28.1 years old. There were 17 primiparous women, 6 multiparous women, 2 cases with gestational weeks < 32 weeks, 7 cases with gestational weeks 32 to 36 weeks, and 14 cases with gestational weeks ≥ 37 weeks.

Inclusion criteria include the following: Meet the diagnostic criteria for gestational hypertension; Singleton pregnancy; Patients and their families sign informed consent forms. Exclusion criteria include: Combination of severe primary diseases such as heart, liver, kidney, etc; Mental disorders cannot cooperate with researchers.

2.2. Method

On the one hand, regular prenatal care should be provided, including regular prenatal check-ups, blood pressure monitoring, dietary guidance (low salt, low-fat diet), and appropriate rest. According to the conventional treatment plan for gestational hypertension, when the blood pressure rises to a certain degree, antihypertensive drugs such as labetalol and nifedipine should be given, and the condition should be closely monitored for changes^[2]. On the other hand, the implementation of comprehensive prevention and intervention measures include:

(1) Health education

Professional medical staff provide health education on gestational hypertension to patients and their families, including the causes, symptoms, hazards, and prevention methods of the disease, to enhance patients' self-management awareness and abilities. They also distribute health education manuals, regularly organize health lectures, and answer patients' questions.

(2) Psychological intervention

It is necessary to pay attention to the psychological state of patients. Due to concerns about the disease and fetal health, patients often experience varying degrees of anxiety and depression. Psychological counseling, relaxation training and other methods help patients alleviate negative emotions and maintain a good mentality.

(3) Weight management

Develop an individualized weight gain plan based on the patient's pre-pregnancy body mass index (BMI), guide the patient on a reasonable diet, control calorie intake, and avoid rapid weight gain. Appropriate exercise should be carried out, such as walking, yoga for pregnant women, etc., but it should be done under the guidance of a doctor to avoid overexertion.

(4) Drug prevention

For patients with high-risk factors such as a history of hypertension before pregnancy, multiple pregnancies, obesity, etc., low-dose aspirin anticoagulation therapy should be given in early pregnancy to prevent placental vascular microthrombus formation, improve placental blood circulation, and reduce the risk of elevated blood pressure. Meanwhile, closely monitor coagulation function.

(5) Regular monitoring

Increase the frequency of prenatal check-ups, in addition to routine blood pressure and urine protein monitoring, and regularly conduct cardiac ultrasound examinations to evaluate cardiac structure and function. Starting from 28 weeks of pregnancy, a weekly cardiac function assessment should be conducted, including measurement of cardiac output, cardiac index, left ventricular ejection fraction, and

other indicators. Early detection and timely treatment of cardiac dysfunction should be carried out.

2.3. Treatment principles

The treatment of gestational hypertension complicated with heart failure should follow the following principles to ensure maternal and infant safety, effectively control the condition and prevent the occurrence of complications^[3].

(1) Quickly control heart failure to ensure maternal and infant safety

The primary task is to quickly alleviate symptoms of heart failure, reduce cardiac load through emergency treatment, improve cardiac function, and ensure the safety of mother and baby's lives.

(2) Comprehensive treatment to stabilize the condition

While controlling the symptoms of heart failure, comprehensive treatment of gestational hypertension, including lowering blood pressure, relieving spasms, etc., can stabilize the condition and prevent further deterioration.

(3) Terminate the pregnancy on time to avoid worsening of the condition

After controlling the symptoms of heart failure, terminate the pregnancy on time according to the condition and fetal condition to avoid worsening of the condition and greater threat to the mother and baby.

(4) Interdisciplinary collaboration to optimize treatment plans

Strengthen collaboration among multiple disciplines such as obstetrics, cardiovascular medicine, anesthesiology, pediatrics, etc., jointly develop and optimize treatment plans, and ensure the effectiveness and safety of treatment.

(5) Pay attention to follow-up monitoring and management to prevent complications

Continue to monitor the patient's vital signs and cardiac function after delivery, promptly detect and treat possible complications, and provide necessary rehabilitation guidance and psychological support^[4].

3. Results

3.1. Maternal and child health status

Out of 23 pregnant women, 1 died, accounting for 4.3% of cases of gestational hypertension complicated with heart failure and 33.3% of cases of gestational hypertension complicated with maternal deaths during the same period. There was also 1 case of cerebrovascular accident and 1 case of circulatory failure.

3.2. Perinatal situation

Among the 27 cases of perinatal infants, 11 cases were premature, accounting for 40.7%; 4 cases of intrauterine growth retardation, accounting for 14.8%; 6 cases of fetal distress, accounting for 22.2%; 5 cases of neonatal asphyxia (Apgar score ≤ 7), accounting for 18.5%; 3 cases of perinatal deaths (including 1 stillbirth), accounting for 11.1%.

4. Discussions

The pathogenesis of gestational hypertension complicated with heart failure is complex, mainly related to increased peripheral resistance caused by systemic small artery spasm, increased cardiac afterload, and myocardial damage caused by placental ischemia and hypoxia releasing various vasoactive substances. Therefore, in the actual

prevention process, it is necessary to implement comprehensive prevention and intervention measures for patients with gestational hypertension, including health education, psychological intervention, weight management, medication prevention, and regular monitoring, to effectively reduce the incidence of heart failure.

4.1. Role of health education and psychological intervention

Through systematic health education, patients can have a deeper understanding of the occurrence, development, and treatment process of diseases, thereby enhancing their self-management ability and better cooperating with treatment and nursing, including understanding the early symptoms of diseases, daily dietary precautions, the importance of reasonable exercise, and the necessity of taking medication on time. For example, medical staff can regularly hold health lectures, distribute promotional brochures, and use new media platforms such as WeChat and apps to provide health information, allowing patients to access relevant information anytime and anywhere. Patients with gestational hypertension often experience significant psychological pressure, worrying about the impact of the disease on the fetus, the effectiveness of treatment, and their health status. These negative emotions may lead to further elevation of blood pressure, increase the burden on the heart, and thus exacerbate the risk of heart failure^[5]. Therefore, psychological intervention has become an important part of preventing heart failure. Psychological intervention measures can include one-on-one counseling, relaxation training, and teaching emotional management skills to help patients learn how to effectively cope with negative emotions and maintain a calm mindset. The practice of psychological intervention in this study showed that through regular psychological counseling and emotional management training, patients' negative emotions were effectively alleviated, and blood pressure fluctuations were correspondingly reduced, thereby reducing the risk of heart failure to a certain extent.

4.2. Weight management and exercise

Weight management and exercise are important means to prevent gestational hypertension complicated with heart failure. Rapid weight gain not only increases the burden on pregnant women's hearts but may also lead to metabolic problems such as insulin resistance and dyslipidemia, further increasing the risk of heart failure. Therefore, reasonable weight management is crucial. In this study, an individualized weight management strategy was adopted, including regular monitoring of weight changes, developing personalized dietary plans, and controlling total calorie intake, which effectively controlled the patient's weight gain and reduced the risk of heart failure caused by rapid weight gain. Meanwhile, appropriate exercise is one of the important measures to prevent heart failure. Exercise can promote blood circulation, improve endothelial function, enhance myocardial contractility, and effectively prevent the occurrence of heart failure. In this study, patients underwent moderate aerobic exercise under the guidance of a doctor, such as walking and yoga for pregnant women. These exercises not only enhance the cardiovascular function of pregnant women but also improve their psychological state, helping them alleviate anxiety and stress.

4.3. Drug prevention

In the prevention of gestational hypertension, drug prevention plays a crucial role, especially the use of low-dose aspirin. Aspirin, as an antiplatelet aggregation drug, can effectively improve the blood circulation of the placenta by inhibiting platelet activity and reducing thrombus formation. This mechanism of action is of great significance for reducing the magnitude of blood pressure elevation, preventing the progression of gestational hypertension to more severe stages, and reducing the risk of heart failure. In this study, low-dose aspirin was administered as

a preventive treatment in early pregnancy for pregnant women with high-risk factors. By closely monitoring the patient's coagulation function, ensure the safety of drug use and avoid adverse reactions such as bleeding. The practice has shown that this drug prevention strategy reduces the magnitude of blood pressure elevation in patients, effectively controls the progression of gestational hypertension, and thus reduces the incidence of heart failure. It is worth noting that although low-dose aspirin has shown some efficacy in preventing gestational hypertension, its use still needs to be strictly controlled according to indications to avoid blind abuse. At the same time, regular monitoring of the patient's coagulation function should be carried out during the treatment process, and medication dosage should be adjusted or discontinued promptly to ensure the safety and effectiveness of the treatment.

4.4. Importance of regular monitoring

Due to the possibility of changes in cardiac structure and function caused by gestational hypertension, which increases the risk of heart failure, regular monitoring of cardiac function can detect abnormalities in cardiac function early, provide a key basis for clinical decision-making, adjust treatment plans on time, and effectively prevent the occurrence of heart failure. Cardiac ultrasound examination, as a non-invasive and accurate diagnostic tool, is an important tool for evaluating the structure and function of the heart. In this study, a strategy was adopted to increase the frequency of cardiac function monitoring, with weekly cardiac function assessments starting from 28 weeks of pregnancy. The evaluation includes measuring indicators such as cardiac output, cardiac index, and left ventricular ejection fraction, which can comprehensively reflect the working status and pumping function of the heart. Through this series of monitoring, multiple potential heart problems were identified, such as heart enlargement and decreased heart function, and timely treatment interventions were given, such as adjusting the dosage of antihypertensive drugs and strengthening diuretic therapy, effectively avoiding the occurrence of heart failure^[6]. Practice has shown that regular monitoring of cardiac function can not only detect heart problems early but also provide the scientific basis for adjusting treatment plans, ensuring the accuracy and effectiveness of treatment. At the same time, regular monitoring can enhance patients' self-management awareness, improve treatment compliance, and further enhance the effectiveness of preventing heart failure. Therefore, in the management of gestational hypertension, the importance of regular monitoring of cardiac function should be highly valued as one of the key measures to prevent heart failure.

5. Conclusion

In summary, gestational hypertension complicated with heart failure poses a threat to the safety of mother and infant life. Taking comprehensive preventive interventions based on routine prenatal care can reduce the incidence of heart failure. Clinical workers should actively promote the application of comprehensive prevention strategies, improve the level of prevention and treatment of gestational hypertension, and safeguard maternal and infant health. In the future, further large-scale and multi-center research is needed to explore more optimized prevention plans and continuously improve the prevention system for gestational hypertension complicated with heart failure.

Disclosure statement

The authors declare no conflict of interest.

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Pelvic Floor Ultrasound for the Diagnosis of Women with Early Postpartum Stress Incontinence

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Abstract: *Objective:* To analyze the diagnostic efficacy of trans-pelvic floor ultrasonography in women with Stress Urinary Incontinence (SUI) in the early postpartum period. *Methods:* Fifty-three patients with SUI who were admitted to the hospital from January 2024 to August 2024 at 42–96 d postpartum underwent ultrasonography and were analyzed in comparison with 35 patients in the control group at 28–32 weeks postpartum, and the bladder pressure grading and strength of myoelectric response as well as uterine contraction were measured on days 1, 7, and 14 after treatment. *Results:* The mean urinary flow rate was $(79.65 \pm 1.24)\%$, $(80.34 \pm 2.14)\%$ and $(86.40 \pm 2.03)\%$ on days 1, 7, and 14 after treatment in the ultrasound group, and $(65.46 \pm 1.58)\%$, $(71.09 \pm 1.47)\%$ and $(85.34 \pm 2.69)\%$ in the control group, respectively ($P < 0.05$). The intensity of myoelectric response in the ultrasound group was (1.69 ± 0.88) points on the 1st day, (3.41 ± 0.98) points on the 7th day, and (4.21 ± 0.77) points on the 14th day after the treatment, and the intensity of myoelectric response in the control group was (1.71 ± 0.91) points on the 1st day, (2.41 ± 0.78) points on the 7th day, and (3.12 ± 0.81) points on the 14th day after treatment in the ultrasound detection group was significantly higher than that of the control group, and the difference was statistically significant ($P < 0.05$). The time of the peak of the strongest uterine contraction in the observation group (53 cases) was (7.36 ± 0.87) d postpartum, and the time of the strongest peak of the strongest uterine contraction in the control group (35 cases) was (25.12 ± 1.24) d postpartum, the observation group was significantly better than the control group ($P < 0.05$). The uterine restoration time in the observation group was (32.69 ± 2.47) d postpartum, and the uterine restoration time in the control group was (45.36 ± 2.69) d postpartum, and the control group was slow and worse than the observation group ($P < 0.05$). *Conclusion:* For women with SUI in the early postpartum period, ultrasound can accurately assess pelvic floor muscle function and muscle strength, which is helpful for early clinical diagnosis and treatment.

Keywords: Pelvic floor muscles; Stress incontinence; Pelvic floor ultrasound; Diagnosis; Treatment

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1. Introduction

The puerperium is a critical period for the recovery of the female reproductive system, during which hormone levels, pelvic ligaments, muscles, the urethra and the bladder change. In some areas of China, rural women experience “urine leakage” after childbirth, with a prevalence of up to 50–80% ^[1]. Postpartum stress urinary incontinence (SUI) is one of the common symptoms, which not only seriously affects the quality of life of patients, but also leads to depression and anxiety ^[2]. Numerous clinical studies have shown that 74% of women with postpartum SUI had varying degrees of depression and anxiety before receiving treatment ^[3]. Therefore, all patients with postpartum SUI should be diagnosed and treated in a timely manner, but at present, the diagnosis of this disease in most hospitals still relies on the patient’s self-description, which is inaccurate and prone to omission and misdiagnosis ^[4]. Traditional medical diagnostic methods mainly include history taking, physical examination and urodynamic examination, but due to the high cost of urodynamic examination, coupled with the limited means of assessment, it is unable to meet the needs of modern medical development ^[5]. In recent years, with the advancement of ultrasound imaging technology, pelvic floor ultrasound has gradually become an effective aid in the diagnosis of SUI and has been widely used in various clinical disciplines. Ultrasound is a non-invasive examination modality with the advantages of simple operation, low price, high accessibility, and intuitive results. In addition, ultrasound imaging can directly observe the pelvic floor structure, better understand the patient’s pelvic floor functional status, help early detection of the patient’s condition, and improve the diagnosis and treatment efficiency. At present, there is a lack of relevant reports on the application of pelvic floor ultrasound in the diagnosis of SUI to explore the diagnostic value of pelvic floor ultrasound in early postpartum SUI mothers, the present study conducted pelvic floor ultrasound examination on 53 cases of SUI mothers admitted to our hospital between January 2024 and August 2024 who had been in the postpartum period of 42–96 days, and analyzed them in comparison with the same period with 35 control cases, to provide a reference basis for the clinic.

2. Information and methodology

2.1. General information

Retrospective analysis of 53 cases of postpartum 42–96 d stress urinary incontinence mothers, aged 18–46 years old, average (35.91 ± 7.04) years old; number of pregnancies 2–4 times, average (3.81 ± 0.64) times; and mode of delivery: normal delivery (29 cases), cesarean section (24 cases), who were seen in the gynecology outpatient clinic and received pelvic floor rehabilitation treatment from January 2024 to August 2024. The 28–32 weeks postpartum patients were collected as the control group. The age of the control group ranged from 17 to 43 years old, with an average of (34.67 ± 5.14) years old; the number of pregnancies was 2–4 times, with an average of (3.52 ± 0.58) times; and the mode of delivery was: normal delivery (19 cases) and caesarean section (16 cases).

According to the definition of SUI in Obstetrics and Gynaecology and the Guidelines for Urodynamic Examination and Evaluation, SUI is defined as the presence of urinary incontinence symptoms within 3 months after delivery. It is diagnosed if there are 3 or more positive signs on bladder and rectal function tests using a homemade urodynamics testing device.

Inclusion criteria: (1) no obvious organic disease or surgical history; (2) age < 40 years old; (3) height ≥ 158 cm, weight ≥ 55 kg; (4) no complications such as hypertension and diabetes mellitus in pregnancy; (5) those with gestational weeks < 37 weeks, greater than 42 weeks, or less than full term were excluded from this case-control study.

Exclusion criteria: (1) combined heart, lung, liver, kidney and other important organs dysfunction; (2) pregnancy, vaginal delivery in the process of serious birth injuries, haemorrhage; (3) combined with coagulation

disorders, cardiovascular and cerebrovascular diseases; (4) combined with neuromuscular disease; (5) combined with mental anomalies, depression, anxiety, and other psychiatric disorders; (6) previous hysterectomy; (7) other factors affecting the quality of the ultrasound image.

2.2. Methodology

In terms of the ultrasound diagnosis, all women underwent pelvic floor ultrasound, and those whose test results showed the presence of pelvic floor laxity were considered to be patients with postpartum stress urinary incontinence. Pelvic floor ultrasound was performed using a two-dimensional, colour Doppler ultrasound diagnostic instrument, with a probe frequency of 3.0–5.0 MHz, a colour Doppler beam speed of 1.0–2.0 cm/s, and an axial scanning position. The first scan was performed by fixing the probe, making the probe slide slowly along the posterior aspect of the pubic symphysis, trying to get as close as possible to the inner cervix and endocervix until the maximum volume of the uterus, and obtaining the horizontal images of the uterus in all its radial lines, and then performing the second scan by moving the probe to the area of the cervical os and attaching the probe to the endocervical os to make the uterine volume relatively larger, and then moving the probe vertically in the centre of the uterine cavity to scan up to the uterine. The whole uterus and uterine adnexa were scanned again to obtain cross-sectional images. All enrolled cases underwent ultrasound examination at the antenatal ultrasound diagnostic clinic of the Centre for Reproductive Medicine of the hospital, where an experienced team of ultrasonographers performed routine examinations. Each time, the ultrasound probe was placed in a head-low-tail-high manner to avoid deformation of the pelvic floor tissues under pressure and was observed in conjunction with abdominal wall muscle contractions, paying attention to changes in the bladder, residual urine volume in the bladder, bladder filling, bilateral uterine size, morphology, and position, etc., as well as recording uterine contraction speed, amplitude, and time, and parameters such as bladder filling, rectal manometry index, and so on.

According to the order of their visits to the clinic were divided into two groups: 53 cases in the ultrasound group, 35 cases in the control group, ultrasound group patients were observed in the obstetrics department for uterine restoration, and then used a unified drug + electrical stimulation for rehabilitation, the specific content is as follows:

- (1) Estrogen: given ethinyl estradiol orally, 20 mg twice a day, each time to be taken for 3 months;
- (2) Non-steroidal anti-inflammatory drugs: given naproxen tablets, 10 mg each, 3 times a day for 3 months;
- (3) Muscle relaxants: given tamsulosin hydrochloride extended-release capsules 10mg, 3 times daily, for 3 months;

The dosage of the above drugs was adjusted according to the different severity of the patient's condition. Bladder pressure grading and myoelectric response intensity were measured on the 1st, 7th and 14th days after treatment.

2.3. Observation indicators

- (1) The sonograms of the uterus in the long axis, short axis, cross-section and vesicourethral system were automatically extracted from the ultrasound images by the “Ultrasound Bed” software, and the uterine contraction rate, the bladder filling degree and the rectal manometric index were calculated, respectively.
- (2) When the bladder is 90% full or more, the urine flow rate is measured, and if the urine flow rate is less than 0.4 mL per minute, it is considered abnormal. The rectal manometric index is the difference between rectal pressure and bladder pressure, the smaller the rectal manometric index, the better the pelvic floor muscle tone.

2.4. Statistical methods

SPSS 23.0 software was applied for statistical analysis, the measurement information was expressed as mean \pm standard deviation (SD), and *t*-test was used for comparison, and the count information was expressed as a rate (%), and χ^2 test was used for comparison, and $P < 0.05$ was considered as a significant difference.

3. Results

3.1. Changes in urodynamic parameters

The mean urinary flow rate on the 1st, 7th and 14th day after treatment was (79.65 ± 1.24)%, (80.34 ± 2.14)% and (86.40 ± 2.03)% in the ultrasound group and (65.46 ± 1.58)%, (71.09 ± 1.47)% and (85.34 ± 2.69)% in the control group, respectively, and the difference was statistically significant in all of them ($P < 0.05$).

The intensity of myoelectric response in the ultrasound group was (1.69 ± 0.88) points on the 1st day, (3.41 ± 0.98) points on the 7th day, and (4.21 ± 0.77) points on the 14th day after the treatment, and the intensity of myoelectric response in the control group was (1.71 ± 0.91) points on the 1st day, (2.41 ± 0.78) points on the 7th day, and (3.12 ± 0.81) points on the 14th day. Ultrasound detection group The intensity of myoelectric response on day 7 and day 14 after treatment was significantly higher than that of the control group, and the difference was statistically significant ($P < 0.05$) (Table 1).

Table 1. Changes in urodynamic indices

Groups	Mean urine flow rate (%)			Strength of myoelectric response (points)		
	Day 1	Day 7	Day 14	Day 1	Day 7	Day 14
Ultrasound group ($n = 53$)	79.65 ± 1.24	80.34 ± 2.14	86.40 ± 2.03	1.69 ± 0.88	3.41 ± 0.98	4.21 ± 0.77
Control group ($n = 35$)	65.46 ± 1.58	71.09 ± 1.47	85.34 ± 2.69	1.71 ± 0.91	2.41 ± 0.78	3.12 ± 0.81
<i>t</i>	47.059	23.311	2.104	0.103	5.066	6.367
<i>P</i>	0.000	0.000	0.038	> 0.05	0.000	0.000

3.2. Comparison of uterine contractions between the two groups of patients

The peak time of the strongest uterine contraction in the observation group (53 cases) was (7.36 ± 0.87) d postpartum, and the peak time of the strongest uterine contraction in the control group (35 cases) was (25.12 ± 1.24) d postpartum, which was significantly better than that of the control group ($P < 0.05$). The time of uterine regrowth after delivery in the observation group was (32.69 ± 2.47) d postpartum, and that in the control group was (45.36 ± 2.69) d, the control group was slow and worse than the observation group ($P < 0.05$) (Table 2).

Table 2. Comparison of uterine contractions between the two groups of patients

Groups	Time to peak uterine contractility (d)	Time to uterine rejuvenation (d)
Ultrasound group ($n = 53$)	7.36 ± 0.87	32.69 ± 2.47
Control group ($n = 35$)	25.12 ± 1.24	45.36 ± 2.69
<i>t</i>	78.993	22.730
<i>P</i>	0.000	0.000

4. Discussion

Currently, the diagnosis regarding postpartum stress urinary incontinence mainly includes pelvic floor X-ray, colposcopy and pelvic floor ultrasound detection. As ultrasound has the advantages of being non-invasive, inexpensive, and easy to operate, it has become one of the preferred methods for clinical diagnosis of urinary incontinence. Previous studies have shown that pelvic floor ultrasound can detect lesions in the anatomical structures of the bladder (e.g., bladder neck, urethral sphincter, pubococcygeal ligament, and periurethral muscles) as well as in the soft tissues surrounding the bladder. There are several reasons why stress incontinence occurs in postpartum women. It may be related to damage to the pelvic floor tissues caused by pregnancy or childbirth, or it may be caused by a decrease in hormone levels after delivery, which results in pelvic floor tissue relaxation. There is also a belief that caesarean section may increase a woman's risk of urinary incontinence, whereas natural childbirth may relatively reduce this risk ^[7]. However, there is no conclusive evidence that natural birth is more likely to result in stress incontinence than caesarean section. Based on this, this paper focuses on whether women who give birth naturally develop stress urinary incontinence. Notably, for patients who develop stress incontinence in the early postpartum period, rehabilitation should be started as early as possible to minimize complications.

Early postpartum stress urinary incontinence (SUI) is a common pelvic floor dysfunction disorder in women, which seriously affects the quality of life and physical and mental health of women. In this study, we compared and analyzed the differences in bladder pressure grading, electromyographic response intensity and uterine contraction between women with SUI and normal women through pelvic floor ultrasonography, and explored the value of pelvic floor ultrasonography in the diagnosis and treatment of SUI.

The results of the study showed that the mean urinary flow rate of the ultrasound group was significantly higher than that of the control group on the 1st, 7th and 14th days after treatment ($P < 0.05$), indicating that pelvic floor ultrasonography was effective in improving the voiding function of women with SUI, which may be related to the fact that ultrasonography can accurately assess the function of the pelvic floor muscles and muscle strength, thus guiding the individualization of the treatment plan. In addition, the intensity of myoelectric response in the ultrasound group was also significantly higher than that in the control group on the 7th and 14th days after treatment ($P < 0.05$), further confirming the important role of pelvic floor ultrasound in assessing the recovery of pelvic floor muscle function.

In terms of uterine contraction, the time to the peak of the strongest uterine contractility was significantly earlier in the observation group than in the control group ($P < 0.05$), and the time to uterine restoration was significantly shorter than in the control group ($P < 0.05$), which suggests that pelvic floor ultrasonography not only improves the symptoms of SUI, but also may promote uterine contraction and restoration, a finding consistent with the results of previous studies, and suggests that pelvic floor ultrasound in postpartum rehabilitation has multiple benefits ^[8].

Pelvic floor ultrasound, as a non-invasive and reproducible examination method, can visualize the anatomical structure of the pelvic floor and dynamically observe the movement of pelvic floor organs. The results of this study further confirmed its advantages in the diagnosis and treatment of SUI. By accurately assessing pelvic floor muscle function and muscle strength, pelvic floor ultrasound provides an important basis for early clinical diagnosis and individualized treatment.

However, there are still some limitations to this study. First, the sample size was relatively small, which may affect the representativeness of the results. Second, long-term follow-up data were lacking to assess the long-term effect of pelvic floor ultrasound on the prognosis of SUI. Future studies may expand the sample size and

extend the follow-up period to further validate the value of pelvic floor ultrasound in the diagnosis, treatment, and prognostic assessment of SUI.

5. Conclusion

In conclusion, pelvic floor ultrasound can accurately assess pelvic floor muscle function and muscle strength in women with SUI in the early postpartum period, which can help early clinical diagnosis and treatment. Ultrasonography not only improves SUI symptoms but also may promote uterine contraction and recuperation. As a non-invasive and reproducible examination method, pelvic floor ultrasound has important application value in the diagnosis and treatment of postpartum SUI. Future studies may further explore the application of pelvic floor ultrasound in the prognostic assessment and personalized treatment of SUI, providing more evidence-based evidence for the comprehensive management of postpartum SUI. For women with stress urinary incontinence in the early postpartum period, early pelvic floor rehabilitation and ultrasound testing can better guide their later treatment and achieve better therapeutic results. Of course, the observation of the long-term efficacy of ultrasound combined with medication in the treatment of postpartum urinary incontinence needs to be further strengthened in order to provide a more accurate and effective reference basis for the clinic.

Disclosure statement

The authors declare no conflict of interest.

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Clinical Analysis of Placental Growth Factor and Soluble FMS-Like Tyrosine Kinase-1 in Serum on the Severity of Preeclampsia

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Abstract: *Objective:* This study aims to analyze the differences in the expression of Placental Growth Factor (PLGF) and soluble Fms-like tyrosine kinase-1 (sFlt-1) in serum and their clinical significance in the severity of preeclampsia. *Methods:* This study selected 58 preeclampsia patients who underwent prenatal check-ups and gave birth in our hospital from September 2021 to September 2023 as the observation group. Based on the severity of their condition, they were divided into a mild group ($n = 38$) and a severe group ($n = 20$). Additionally, 795 healthy pregnant women who underwent prenatal check-ups in the hospital during the same period were included as the control group. Pearson correlation analysis was used to examine the correlation between serum sFlt-1 and PLGF expression and the severity of preeclampsia. *Results:* The observation group had higher sFlt-1 and lower PLGF levels compared to the control group. The severe group had higher sFlt-1 levels and lower PLGF levels compared to the mild group. The 24-hour urinary protein level was significantly higher in the observation group than in the control group ($p < 0.05$). Pearson correlation analysis revealed a positive correlation between 24-hour urinary protein quantification and serum sFlt-1 levels and a negative correlation with PLGF expression in preeclampsia patients ($p < 0.05$). *Conclusion:* The expression of sFlt-1 and PLGF in serum is closely related to the severity of preeclampsia, suggesting their potential as biomarkers for assessing the severity of preeclampsia.

Keywords: Placental Growth Factor; Soluble Fms-like tyrosine kinase-1; Preeclampsia

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1. Introduction

Preeclampsia (PE) is a complex syndrome specific to pregnancy, characterized by hypertension and proteinuria. It commonly occurs in pregnant women after 20 weeks of gestation ^[1]. Previous studies have found that the incidence of PE ranges from 2% to 8% ^[2]. PE not only threatens the health of the mother but may also lead to fetal growth restriction, intrauterine distress, premature birth, and increased risk of cardiovascular disease. Although the exact cause of this disease is not fully understood, studies have suggested that placental dysplasia, inadequate blood

flow supply, and placental hypoxia play a central role^[3]. PLGF is a protein that promotes blood vessel growth, stimulating cell proliferation, differentiation of vascular endothelial cells, and angiogenesis. Conversely, sFlt-1 is a natural inhibitor of VEGF, strongly inhibiting its effects^[4]. When PLGF binds to sFlt-1, it inhibits the angiogenic effect of PLGF, affecting the remodeling of spiral arteries in placental blood vessels, reducing placental blood perfusion, and triggering the onset of PE^[5]. Therefore, this study aims to analyze the correlation between serum levels of PLGF and sFlt-1 and the severity of PE, aiming to provide more effective monitoring and intervention strategies for clinical practice, thereby improving the prognosis of both mother and child.

2. Materials and methods

2.1. General information

After review and approval by the hospital's medical ethics committee, 58 PE patients who underwent prenatal check-ups and gave birth in the hospital were selected as the observation group. Based on the severity of their condition, they were divided into a mild group ($n = 38$) and a severe group ($n = 20$). Additionally, 795 healthy pregnant women who underwent prenatal check-ups in the hospital during the same period were included as the control group. The observation group consisted of women aged 23–35 years, with an average age of (27.41 ± 3.30) years old, a gestational age range of 23–36 weeks, with an average of (31.68 ± 4.15) weeks. There were 42 primiparous and 16 multiparous women, with a body mass index ranging from 23–29 kg/m², averaging (24.08 ± 1.13) kg/m². The control group consisted of women aged 21–33 years old, averaging (26.83 ± 3.45) years old, with a gestational age range of 22–37 weeks, averaging (32.69 ± 4.57) weeks. There were 597 primiparous and 198 multiparous women, with a body mass index ranging from 22–29 kg/m², averaging (24.21 ± 1.43) kg/m². There were no statistically significant differences in baseline characteristics between the two groups ($p > 0.05$), indicating comparability.

2.2. Inclusion and exclusion criteria

Inclusion criteria: (1) Meet the diagnostic criteria for PE^[6], including new-onset hypertension (blood pressure $\geq 140/90$ mmHg) after 20 weeks of gestation with or without proteinuria (≥ 0.3 grams/24 hours); (2) Singleton pregnancy; (3) All participants must sign an informed consent form after fully understanding the study content.

Exclusion criteria: (1) Have chronic hypertension, diabetes, kidney disease, heart disease, or other chronic systemic diseases; (2) Experience severe complications during pregnancy, such as placenta previa, placental abruption, etc.; (3) Are receiving medication that may affect blood pressure or proteinuria levels.

2.3. Methods

- (1) Detection of serum PLGF and sFlt-1: Draw 3 mL of fasting elbow venous blood from the pregnant woman. After the blood clots, centrifuge it at a rate of 3000 r/min for 10 minutes to separate the serum and store it frozen at -80°C . Use an electrochemical luminescence analyzer (Ningbo Aocheng Biotechnology Co., Ltd., model: Shine i1910) for measurement.
- (2) 24-hour urine protein level detection: Collect urine from the pregnant woman from 8 a.m. on the day after admission to 8 a.m. on the following day. Use the orthophenanthroline molybdenum colorimetric method to determine the protein content in the 24-hour urine sample.

2.4. Observation indicators

According to the relevant diagnostic criteria for PE in “Obstetrics and Gynecology,” 38 patients with 24-hour urine protein quantification < 300 mg were included in the mild group, and 20 patients with 24-hour urine protein \geq 300 mg were included in the severe group.

2.5. Statistical analysis

The study used SPSS 20.0 statistical software to process the data. Count data were presented as percentages (%) and analyzed using the χ^2 test. For measurement data that followed a normal distribution, they were presented as (\pm s) and processed using the *t*-test. Intra-group data analysis was performed using the *q*-test, and correlation analysis was performed using the Pearson method. All tests used two-sided probability tests, and the results were considered statistically significant when the *P*-value was less than 0.05.

3. Results

3.1. sFlt-1 and PLGF levels in the control group and observation group

The sFlt-1 level in the observation group was higher than that in the control group, while the PLGF level was lower ($p < 0.05$). See **Table 1**.

Table 1. Comparison of sFlt-1 and PLGF levels between the control group and the observation group (\pm s, pg/mL)

Group	<i>n</i>	sFlt-1	PLGF
Control group	795	2036.77 \pm 362.33	488.36 \pm 117.19
Observation group	58	5025.56 \pm 1038.31	248.41 \pm 63.22
<i>t</i>	-	46.468	15.425
<i>p</i>	-	< 0.001	< 0.001

3.2. Levels of sFlt-1 and PLGF in mild and severe groups

The level of sFlt-1 in the severe group was higher than that in the mild group, while PLGF was lower in the severe group compared to the mild group ($p < 0.05$). See **Table 2**.

Table 2. Comparison of sFlt-1 and PLGF levels between mild and severe groups (\pm s, pg/mL)

Group	<i>n</i>	sFlt-1	PLGF
Mild group	38	3245.42 \pm 736.74	301.28 \pm 56.45
Severe group	20	8438.78 \pm 1515.68	148.76 \pm 63.60
<i>t</i>	-	46.989	19.688
<i>p</i>	-	< 0.001	< 0.001

3.3. 24-hour urine protein levels in control and observation groups

The 24-hour urine protein level in the observation group was significantly higher than that in the control group ($p < 0.05$). See **Table 3**.

Table 3. Comparison of 24-hour urine protein between control and observation groups (\pm s, g/24h)

Group	<i>n</i>	24h urine protein
Control group	795	0.21 \pm 0.05
Observation group	58	2.06 \pm 0.59
<i>t</i>	-	84.930
<i>p</i>	-	< 0.001

3.4. Correlation analysis

According to Pearson correlation analysis, there was a positive correlation between 24-hour urine protein quantification and serum sFlt-1 level expression in preeclampsia patients ($r = 0.672$, $p < 0.001$), and a negative correlation with PLGF expression ($r = -0.513$, $p < 0.001$).

4. Discussion

Research has shown that damage and activation of vascular endothelial cells are key factors in the development of preeclampsia (PE). Abnormal expression of PLGF and its receptors is also closely related to endothelial cell damage ^[7]. After vascular endothelial cells are damaged, vascular permeability increases, leading to tissue hypoxia and blood concentration. Meanwhile, coagulation factor levels increase, while anticoagulant proteins and fibrinolytic factor levels decrease, resulting in an imbalance between the coagulation system and fibrinolytic system, which can easily lead to thrombosis or bleeding tendency. The prothrombotic state can cause fibrin deposition in the decidua of the uterine spiral arteries, damaging the placental vasculature and causing placental ischemia, hypoxia, and dysfunction. Subsequently, the placenta releases cytotoxic substances, further damaging the function of the mother's vascular endothelial cells, ultimately leading to the occurrence of PE and affecting the pregnancy outcome of the pregnant woman ^[8].

The results of this study indicate that the sFlt-1 level in the observation group was higher than that in the control group, while the PLGF level was lower. Within the observation group, the severe subgroup exhibited a higher sFlt-1 level and a lower PLGF level compared to the mild subgroup. Additionally, the 24-hour urinary protein level in the observation group was significantly higher than that in the control group ($p < 0.05$). The primary reason for these differences is placental insufficiency and vascular endothelial damage caused by preeclampsia (PE). sFlt-1, a protein produced by the placenta, regulates the biological effects of VEGF and PLGF by binding to and neutralizing them. Elevated levels of sFlt-1 can trigger vascular inflammatory responses and pathological changes, leading to edema, vasoconstriction, and other preeclampsia-related symptoms ^[9]. PLGF, a placental growth factor, plays a crucial role in regulating vascular permeability and angiogenesis. Its levels are influenced by placental blood flow conditions. Pregnant women with preeclampsia often experience abnormal placental blood flow and vascular issues, reflected in PLGF level changes. When PLGF levels decrease, the proliferation of endothelial trophoblasts increases, and their infiltration capacity decreases, leading to placental hypoxia and ischemia, ultimately triggering preeclampsia ^[10]. According to Pearson correlation analysis, there is a positive correlation between 24-hour urinary protein levels and serum sFlt-1 levels and a negative correlation with PLGF levels in women with preeclampsia ($p < 0.05$). These findings align with the research results of Zhao Shenglong *et al.* ^[11], indicating that using sFlt-1 and PLGF to diagnose PE has high sensitivity and specificity. PE

can cause placental insufficiency and systemic vascular endothelial damage. As an anti-angiogenic factor, elevated sFlt-1 levels reflect inhibition of placental angiogenesis and widespread endothelial damage, leading to impaired renal filtration and increased urinary protein excretion. Conversely, decreased PLGF levels signify a further reduction in placental blood flow and functional deterioration, exacerbating renal damage and increasing urinary protein levels.

5. Conclusion

In summary, serum sFlt-1 and PLGF expression are closely related to the severity of preeclampsia, serving as potential biomarkers for assessing PE severity. The increase in sFlt-1 and decrease in PLGF correlate with the progression of PE, aiding in early diagnosis and risk assessment using these biomarkers.

Disclosure statement

The authors declare no conflict of interest.

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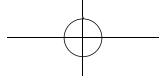
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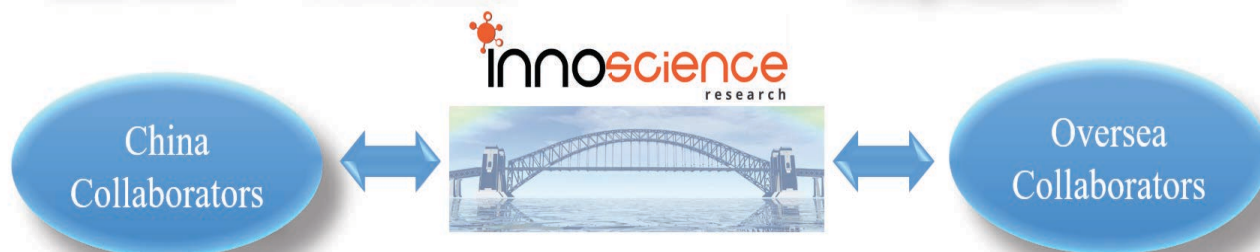
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