

# Clinical Characteristics and Prognosis of Neurological Disorders During Pregnancy

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**Objective:** To investigate the common clinical characteristics of neurological disorders during pregnancy, their impact on both the mother and the infant, and the factors influencing prognosis.

**Methods:** Medical data of 49 pregnant women with concurrent neurological disorders during pregnancy and up to six weeks postpartum was collected and analyzed in the retrospective study. The cases were grouped based on three criteria: etiology related to pregnancy-related diseases, receiving surgical treatment or not, and onset to diagnosis (O-D) duration. Clinical characteristics and prognosis were compared among different groups.

**Results:** Neurological disorders during pregnancy mainly manifested headaches with nausea and vomiting followed by convulsion. Women in the pregnancy-related disease group were younger, had a higher BMI, and later gestational week of onset compared to those in the non-pregnancy-related disease group. There were no statistically significant differences in maternal and fetal mortality between the groups. Maternal BMI and gestational week of onset were lower in the surgical treatment group compared to those in the non-surgical treatment group. However, there were no statistically significant differences in the remaining clinical characteristics, and maternal and pediatric prognosis between the two groups. The long O-D group had a younger maternal age and lower Glasgow scores than the short O-D group, with no significant difference in maternal and pediatric prognosis. Maternal deaths were positively correlated with Glasgow scores.

**Conclusion:** In cases of pregnant women reporting symptoms such as headache, dizziness, nausea, vomiting, and intermittent convulsions, the possibility of comorbid neurological disorders of pregnancy must also be taken into account. Enhancing obstetric examinations, facilitating early detection and diagnosis are critical to achieving favorable outcomes for both mothers and infants.

**Keywords:** diagnosis and treatment, neurological disorders, pregnancy, pregnancy outcome prognosis

## Background

Neurological disorders in pregnancy refer to neurological disorders that occur during pregnancy or are associated with pregnancy, which is a relatively rare neurological emergency.<sup>1</sup> Seizure disorders are the most frequent major neurologic complication in pregnancy, affecting 0.3–0.8% of all gestations.<sup>2</sup> Previous studies showed that increased risk of gestational hypertensive disorders (odds ratio, 1.37; 95% confidence interval, 1.21–1.55) in women with epilepsy.<sup>3</sup> Cerebrovascular diseases rank the second common neurological disorders associated with pregnancy, which can have many etiologies, including pregnancy, puerperium, oral contraceptive pills (OCP), coagulopathies, intracranial infections, cranial tumors, lumbar puncture, malignancy, dehydration, connective tissue disorders, inflammatory bowel disease, Behcet's disease, parenteral infusions and various drugs.<sup>4</sup> It may present with various signs and symptoms of intracranial hypertension (headache, nausea, vomiting, visual disturbances, papilledema, focal neurological deficits and/or seizures), hyperthyroidism, paroxysmal nocturnal hemoglobinuria, ruptured intravenous carotid artery aneurysm, polycythemia, and iron deficiency anemia. Most important diagnostic test is CT, MRI, MRV, cerebral angiography of brain, and D-

dimer levels.<sup>5</sup> Diagnosis of neurological disorders during pregnancy can be challenging, especially in the context of the peripartum period.

Neurological disorders and their treatments can significantly impact pregnancy, childbirth, and the postpartum period. The distinctive physiological characteristics of pregnancy can lead to the rapid onset and severity of certain neurological disorders. Given the high rates of death and disability associated with these conditions, neurological disorders during pregnancy rank as the second most common cause of maternal death from indirect causes in the United Kingdom.<sup>6</sup>

The risk of cerebral hemorrhage is increased during pregnancy and the postpartum period, accounting for 25% of maternal deaths.<sup>7</sup> Efficient management of new or recurring severe neurological comorbidities during pregnancy, accurate identification of these conditions, and prompt initiation of treatment are crucial to decreasing maternal mortality and disability rates.

In this study, we retrospectively analyzed case data of patients with neurological disorders in pregnancy who were admitted to the First Affiliated Hospital of Xinjiang Medical University over the past nine years. The main objective was to study the characteristics of disease occurrence and identify preventive measures to reduce the mortality rate of mothers and infants.

## Materials and Methods

### Study Participants

The case data of 49 patients admitted to the First Affiliated Hospital of Xinjiang Medical University between January 2013 and December 2022 were analyzed. This study was conducted with approval from the Ethics Committee of the First Affiliated Hospital of Xinjiang Medical University. This study was conducted in accordance with the declaration of Helsinki. Informed consent is not required for this study because it is a retrospective study. However, anonymized data analysis was conducted for the article only with good confidentiality. The patients' ages ranged from 21 to 44 years old, with a mean age of  $30.75 \pm 5.36$  years. The gestational weeks ranged from 7 to 41+5 days, with a mean of  $28.44 \pm 10.51$  weeks. There were 39 primigravid women and 10 multiparous women, with a mean number of pregnancy of  $2.0 \pm 1.0$ , and the average number of births was  $0.9 \pm 0.85$ . The clinical symptoms they presented with included headaches, dizziness, nausea, vomiting, convulsions, and blurred vision. In severe cases, brain damage, loss of consciousness, and limb weakness were observed.

### Research Methods

In this retrospective analysis of 49 pregnant women with neurological disorders during pregnancy, their general and clinical data, clinical manifestations, diagnostic and therapeutic processes, as well as pregnancy outcomes, were examined. Diagnostic criteria were referenced from *Practical Clinical Neurology*.<sup>8</sup> The diagnostic criteria of neurological disorders in pregnant women are the same as those in general patients.

Based on relevant literature reports and clinical practice, patient groupings were made as per three aspects: whether the etiology was related to pregnancy-related diseases, whether the patient received surgical treatment, and onset to diagnosis (O-D) duration. The clinical characteristics and factors affecting prognosis were analyzed in terms of maternal age, BMI, gestational week of onset, number of maternal deliveries, and number of deaths.

### Statistical Methods

All data were analyzed using SPSS 25.00 software for data analysis. Measurement data were described using the mean  $\pm$  standard deviation (SD) if they conformed to a normal distribution, and the independent sample *t*-test was used for comparisons between groups. If the data were not normally distributed, they were presented as the median (M) and interquartile range (Q), and the rank sum test was used for between-group comparisons. Categorical data were expressed as frequencies and rates, and the  $\chi^2$  test was used for between-group comparisons. Multivariate logistic regression analysis was used to identify factors associated with the prognosis of patients with neurological disorders in pregnancy. A *P* value of  $< 0.05$  was considered indicative of statistical significance.

## Results

### Clinical Diagnosis

Among the 49 patients, there were 12 cases of cerebral hemorrhages, 8 cases of venous sinus thrombosis, 6 cases of cerebral hemorrhages combined with venous sinus thrombosis, 2 cases of cerebral hemorrhages combined with cerebral herniation, 5 cases of cerebral infarcts, 1 case of cerebral infarction combined with venous sinus thrombosis, 1 case of venous sinus thrombosis combined with cerebral herniation, and 5 cases of reversible posterior encephalopathy syndrome, 2 cases of intracranial occupation, 2 cases of intracranial occupation with hemorrhage, 2 cases of epilepsy, 1 case of epilepsy secondary to intracranial hemorrhage, 1 case of intracranial complications secondary to epilepsy, and 1 case of transient ischemic attack.

### Clinical Symptoms

Initial symptoms reported were as follows: 7 (14.29%) patients presented with convulsions, including 1 with limb weakness and 3 with loss of consciousness. Nausea and vomiting were the initial symptoms reported in 4 cases (8.16%). One patient had convulsions, blurred vision, and loss of consciousness, while another also had accompanying convulsions, and two other patients had loss of consciousness. Thirty-two patients (65.31%) initially presented with headaches, mostly accompanied by nausea and vomiting. Among them, 6 also had other accompanying symptoms of varying degrees of limb dysfunction, and 7 cases were aggravated by loss of consciousness. Three cases (6.12%) presented with dizziness, including 1 case with slurred speech. In two cases (4.08%), the initial symptom manifested as a speech disorder. In one case (2.04%), the initial symptom was limb disorder caused by compression from the glioma, leading to motor impairment in one limb accompanied by loss of vision.

### Time of Onset

Seven patients developed symptoms in early pregnancy and terminated their pregnancies with medication or abortion. Among them, 4 patients had a good prognosis after treatment, 2 patients required rehabilitation, and 1 patient died of a serious illness.

Twelve patients with mid-pregnancy onset underwent induced labor or removal by cesarean section, and none of the newborns survived except for 2 fetuses removed by cesarean section after 26 weeks of gestation. Five patients were treated and showed improvement. Five patients required rehabilitation, and 1 patient died due to brain metastasis from the lung cancer.

Sixteen patients developed symptoms in late pregnancy. Among them, ten improved after delivery, 2 patients underwent rehabilitation, and 4 died.

There were 14 cases of postpartum morbidity, with 11 patients showing improvement after treatment, 1 patient underwent rehabilitation, and 2 deaths.

### Pregnancy Outcomes

Thirty-one patients improved after treatment without any significant complications. Ten patients required rehabilitation, and most of them had hemorrhages and infarcts at critical sites, resulting in limited limb movement. They underwent rehabilitation exercises to improve their quality of life. Eight cases resulted in death. One patient had severe prenatal eclampsia, with postpartum symptoms of dizziness, aggravated convulsions, and coma. Her nuclear cranial CT suggested infarction of the brainstem and basal ganglia region, and the cause of death was a subarachnoid hemorrhage. Another patient with severe prenatal eclampsia and hemolysis, elevated liver enzyme levels, and low platelet levels (HELLP) syndrome developed postpartum eclampsia on the day of the cesarean section with a massive hemorrhage in most of the brain and died due to brain herniation. One patient had an intracranial venous sinus thrombosis, which resulted in brain herniation and death. One patient with choriocarcinoma and lung and brain metastases died due to multiorgan failure. Two patients with brain metastasis from lung cancer died of the same cause. One patient had a cerebral hemorrhage and died due to a basal ganglia hemorrhage. One patient died as a result of extensive venous sinus occlusion.

A total of 25 fetuses survived, mostly at 30 weeks of gestation or later. There were 15 fetal deaths: 8 passed away at 26 weeks of gestation or later, 2 were intrauterine deaths, 2 died after birth, and the remaining 3 died during induced labor.

## Comparison of General Information and Prognosis of Mothers and Infants in Different Subgroups

### Etiology

There were 17 patients in the pregnancy-related diseases group. The comorbid diseases included hypertension in pregnancy, preeclampsia, eclampsia, HELLP syndrome, postpartum eclampsia, and choriocarcinoma. In the non-pregnancy-related diseases group, there were 16 cases, which included intracranial vascular lesions, aneurysms, moya-moya disease, benign intracranial tumors, malignant cerebral tumors (cerebral glioma), chronic hypertension, and lung cancer. Patients in the pregnancy-related diseases group had a later gestational week of onset, more pregnancies and births, and a higher BMI during pregnancy compared to the non-pregnancy-related diseases group. No statistically significant differences were observed between the two groups in terms of maternal and perinatal deaths (Table 1 and Table 2).

### Treatment

The surgical treatment group consisted of 18 patients who underwent procedures such as intracranial hematoma removal, cranial decompression, intracranial aneurysm clamping, intracranial occupational resection, encephalography, and venous sinus thrombolysis. The non-surgical treatment group consisted of 31 patients, and their treatments included blood pressure control, cranial pressure reduction, dehydration, hemostasis, neurotrophic therapy, anticoagulation, and thrombolytic therapy. A comparison of clinical characteristics and maternal and pediatric prognosis between the surgical treatment group and the non-surgical treatment group showed no statistically significant differences (Table 3 and Table 4).

**Table 1** Comparison of Clinical Characteristics and Outcomes of Pregnant Women With Neurological Disorders in the Pregnancy-Related Disease Group and the Non-Pregnancy-Related Disease Group

Groups	Cases	Age	BMI	Gestational Week of Onset	Gravidity	Parity	Duration of O-D	Number of Deaths
Pregnancy-related disease group	16	29.04±4.1	25.85±3.4	34.32±4.2	1.96±1.5	1.08±0.9	4.54±7.8	3
Non-pregnancy-related disease group	33	31.90±5.3	23.74±1.9	24.67±10.8	1.82±0.7	0.784±0.8	5.49±14.1	5
$t/\chi^2$		-2.32	3.48	5.56	0.43	1.48	-3.09	0.102
P		0.023	0.01	0.001	0.672	0.142	0.758	0.749

**Table 2** Comparison of Perinatal Clinical Characteristics and Outcomes of Pregnant Women With Neurological Disorders in the Pregnancy-Related Disease Group and Non-Pregnancy-Related Disease Group

Groups	Cases	Weight	Apgar Score	Number of Deaths
Pregnancy-related disease group	16	2132.29±833.8	8.3±0.9	4
Non-pregnancy-related disease group	26	2317.0±909.0	7.9±1.6	13
$t/\chi^2$		-0.74	0.86	2.569
P		0.465	0.392	0.109

**Table 3** Comparison of Clinical Characteristics and Outcomes of Pregnant Women With Neurological Disorders in the Surgical and Non-Surgical Groups

Groups	Cases	Age	BMI	Gestational Week of Onset	Gravidity	Parity	Duration of O-D	Number of Deaths
Surgical group	21	30.49±4.5	23.06±3.8	25.33±11.5	1.67±0.7	0.78±0.8	2.97±6.0	4
Non-surgical group	28	31.47±5.7	23.74±1.9	30.12±8.3	2.05±1.3	0.97±0.9	7.34±16.1	4
$t/\chi^2$		0.838	1.987	2.063	1.633	1.001	1.567	0.199
P		0.405	0.054	0.043	0.108	0.320	0.124	0.655

**Table 4** Comparison of Clinical Characteristics and Outcomes of Perinatal Infants in the Surgical and Non-Surgical Treatment Groups of Pregnant Women With Neurological Disorders

Groups	Cases	Weight	Apgar Score	Number of Deaths
Surgical group	17	2240.95±1023.29	8.54±0.88	8
Non-surgical group	25	2212.78±745.70	7.91±1.44	9
$t/\chi^2$		-0.110	-1.416	0.514
P		0.913	0.166	0.474

### O-D Duration

The interval between the onset of initial symptoms and the confirmed diagnosis (O-D duration) is linked to prognosis.<sup>9</sup> The short O-D group had a higher rate of surviving newborns at the clinic compared to the long O-D group, and the comparison of maternal and pediatric prognosis between these two groups was not statistically significant (Table 5 and Table 6).

**Table 5** Comparison of Clinical Characteristics and Maternal and Infant Outcomes in Pregnant Women With Neurological Disorders in the Long O-D Value and Short O-D Value Groups

Groups	Cases	Age	BMI	Gestational Week of Onset	Gravidity	Parity	Glasgow Score	Number of Deaths
Long O-D	21	29.58±3.1	25.00±4.0	28.10±10.1	1.81±1.2	0.88±0.8	6.41±5.5	5
Short O-D	28	32.10±6.1	23.59±3.0	27.49±10.5	1.90±0.9	0.88±0.8	10.64±3.9	3
$t/\chi^2$		-2.335	1.304	0.257	-0.364	-0.011	-2.422	1.506
P		0.023	0.200	0.798	0.717	0.991	0.022	0.220

**Table 6** Comparison of Clinical Characteristics and Maternal and Infant Outcomes Between Perinatal Infants in the Long O-D Value and Short O-D Value Groups of Pregnant Women With Neurological Disorders

Groups	Cases	Weight	Apgar Score	Number of Deaths
Long O-D	17	2096.96±635.5	7.84±1.3	5
Short O-D	25	2343.00±1036.8	8.47±1.3	12
$t/\chi^2$		-1.00	-1.483	1.451
P		0.323	0.147	0.228

## Discussion

### Clinical Features of Neurological Disorders Associated with Pregnancy

Neurological disorders are serious complications that can occur during pregnancy and the postpartum period. The unique physiological changes in pregnancy can contribute to the rapid onset, unfavorable diagnosis, and treatment challenges in certain neurological disorders, leading to high rates of death and disability. These factors significantly impact the prognosis of both mothers and infants.<sup>10</sup>

#### Comorbid Cerebrovascular Disease in Pregnancy

It is relatively common to encounter pregnancy with coexisting cerebral hemorrhage, intracranial venous thrombosis, and cerebral infarction, among other conditions, in clinical practice. These have a sudden onset, with no obvious specific symptoms initially, resulting in rapid progression and increased severity and complexity. Consequently, diagnosing these conditions is challenging, affecting the accuracy and timeliness of treatment. The initial clinical manifestations, such as nausea and vomiting, can easily be misdiagnosed as digestive system disorders associated with pregnancy. Additionally, most patients also have coexisting hypertensive disorders during pregnancy, which can be easily mistaken for eclampsia. This diagnostic confusion often leads to delayed identifying and treating the condition, resulting in adverse outcomes for both mothers and infants.<sup>11</sup>

Literature reviews from multiple international databases have shown that the incidence of stroke in pregnant women ranges from 4 to 41 per 100,000 births.<sup>8</sup> One of the most common causes is eclampsia, a pregnancy-specific disorder characterized by high blood pressure during pregnancy. Hypertensive disorders of pregnancy typically occur after the 20<sup>th</sup> week of gestation and are marked by an increase in blood volume, which is often accompanied by elevated blood pressure. These physiological changes can lead to hemodynamic alterations and endothelial dysfunction in blood vessels, thereby increasing the risk of cerebral hemorrhage.<sup>12</sup>

#### Comorbid Intracranial Space-Occupying Tumors in Pregnancy

Pregnancy outcomes can be complicated by the presence of various types of brain tumors. The most common benign tumors are meningiomas and pituitary tumors, while gliomas are the more prevalent malignant tumors.<sup>13</sup> Tumor growth can be significantly impacted during pregnancy because of the unique physiological changes involved in pregnancy. For instance, fluid retention during pregnancy can lead to edema enlargement in benign tumors such as meningiomas. Additionally, pregnancy hormones act on hormone receptors in tumors, accelerating their growth and increasing tumor size. Pregnant patients with brain malignancies have been found to exhibit significant radiological expansion of tumor growth during pregnancy compared to the prenatal and postnatal periods.<sup>14</sup>

#### Comorbid Epilepsy in Pregnancy

Comorbid epilepsy in pregnancy is a serious condition that can affect both the mother and the infant. Several antiepileptic drugs, such as valproic acid and carbamazepine, can increase the risk of high blood pressure during pregnancy, spontaneous abortion, abnormal fetal position, and fetal spina bifida. The incidence of abnormal fetal position and spontaneous abortion has been found to be 1–2% in the general population, and this increases to 3–9% in patients treated with antiepileptic drugs.<sup>15</sup> However, it has also been shown that there is no increase in overall perinatal mortality.<sup>16</sup> Despite these risks associated with epilepsy in pregnancy, more than 90% of patients can still have a normal pregnancy. Pre-pregnancy folic acid supplementation reduces the incidence of fetal position abnormalities and fetal spina bifida.<sup>17</sup>

#### Posterior Reversible Encephalopathy Syndrome in Pregnancy

Posterior reversible encephalopathy syndrome (PRES), formerly known as reversible posterior leukoencephalopathy syndrome, is a rare condition that can occur in women with hypertensive disorders of pregnancy. The main feature of PRES is reversible subcortical angiogenic edema in the posterior regions of the brain. Although the exact etiology of PRES is unknown, it is thought to be related to endothelial dysfunction causing cytotoxic edema, disrupted cerebral vasoregulation leading to vasogenic edema, and vasospasm.<sup>18</sup> The condition is characterized by neurological symptoms such as headache, dizziness, nausea, vomiting, visual disturbances, convulsions, and coma, which are usually reversible.<sup>19</sup>



# Diagnosis and Treatment of Neurological Disorders in Pregnancy

## Diagnosis of Comorbid Neurological Disorders in Pregnancy

In this study, 63.27% of the patients (31/49 cases) had headache, 44.90% (22/49 cases) had nausea and vomiting, 22.45% (11/49 cases) had convulsive symptoms, 20.41% (10/49 cases) had loss of consciousness, 14.29% (7/49 cases) had accompanying limb motor dysfunction, 8.16% (4/49 cases) had blurred vision, and only 4.08% (2/49 cases) showed exclusive speech dysfunction. In cases of pregnant women reporting symptoms such as headache, dizziness, nausea, vomiting, and intermittent convulsions, in addition to considering hypertensive disorders of pregnancy, eclampsia, and gastrointestinal disorders, the possibility of comorbid neurological disorders of pregnancy must also be taken into account.

Auxiliary examinations primarily include cranial computed tomography (CT), magnetic resonance imaging (MRI), magnetic resonance venography (MRV), digital subtraction angiography (DSA), and electroencephalogram (EEG). Due to concerns about fetal exposure to radiation, cranial MRI and MRV are generally preferred. Cranial CT and DSA are performed when necessary. CT examinations may be conducted to diagnose cerebral infarction and cerebral hemorrhage, with adequate precautions for protecting the abdomen. Studies show that the risk of fetal tissue damage and dysfunction caused by CT examination during pregnancy is extremely low. It does not result in fetal intellectual developmental disorders, and the probability of fetal radiation effects from CT scanning is extremely low.<sup>20</sup>

## Treatment of Comorbid Neurological Disorders in Pregnancy

In this study, 24 patients were promptly diagnosed upon onset of symptoms and received immediate treatment. Two patients developed cerebral hernias, one occurring during mid-term pregnancy. The patient survived after an immediate cesarean section, but the child did not survive. Additionally, two pregnant women who sought medical treatment two weeks after the onset of symptoms were hospitalized but did not survive despite the immediate interventions. Two patients with cerebral hemorrhage were investigated for brain metastasis from lung cancer and underwent an induced abortion, ultimately resulting in death due to lung cancer. Another patient died after delivery due to multiple organ metastases of choriocarcinoma.

Once the diagnosis is clear, treatment should be proactive with the multidisciplinary involvement of obstetricians, neurologists, neurosurgeons, and other specialists based on the international guidelines on treatment of neurological disorders in pregnant women. Collaborative treatment protocols must be developed to address various diseases, ultimately aimed at reducing maternal and infant mortality. Patients with pregnancy and comorbid intracranial venous sinus thrombosis deal with a particularly aggressive clinical course, with a mortality rate of 10% to 20% and a disability rate of 20–30%.<sup>21</sup> Treatment involves aggressive anticoagulation and thrombolytic therapy. In this study, we found favorable outcomes in cases where anticoagulation was immediately administered. Four patients underwent cerebral angiography and received anticoagulation interventions postoperatively. Two patients had residual hemiparesis and underwent rehabilitation. One patient with extensive venous sinus thrombosis who underwent intravenous thrombolysis and thrombectomy died due to the severity of the condition.

When cerebrovascular arteriovenous malformations rupture and cerebrovascular aneurysms occur during pregnancy, the mortality rate can reach as high as 30–35%.<sup>22</sup> For patients experiencing a small amount of bleeding and mild clinical symptoms, conservative internal treatment is a viable option. In those in a stable condition with gradually improving symptoms, the pregnancy can be carried to full term, ensuring that forceful breath-holding is avoided during delivery. However, in patients with significant bleeding, severe clinical symptoms, or signs of brain herniation, immediate surgery is necessary to remove the hematoma.

Patients who may face challenges with radical surgery can choose conservative treatment initially, with the option of considering a cesarean section after 36 weeks of gestation before hematoma removal. For patients who develop an intracranial hemorrhage during late pregnancy or full-term pregnancy, a cesarean section is preferred to safeguard the health of both the mother and the fetus.<sup>23</sup> If the patient is in a critical condition, a cesarean section can be performed concurrently with a craniotomy.

Emergency management of patients with cerebral hemorrhage involves dehydration treatment as a key intervention, with appropriate and judicious use of dehydration drugs. Dehydration therapy in the acute phase, especially in the

ultra-early phase, reduces cerebral edema and prevents brain herniation. Antispasmodic agents such as magnesium sulfate increase the endothelial synthesis of prostaglandins, leading to vasodilatation. This can eliminate cerebral edema and stop convulsions without adverse effects on the contractions or the fetus. In emergency cases, once the diagnosis of intracranial hemorrhage or hematoma formation is confirmed, thorough preoperative preparations for craniectomy under general anesthesia should be made. Simultaneously, a cesarean section under local anesthesia should be performed swiftly to deliver the fetus, followed by immediate removal of the hematoma through a craniectomy under general anesthesia. This approach ensures that the fetus is not affected by general anesthesia while also avoiding any delay in the surgery time for craniotomy to remove the hematoma, making it a safer and more reliable method.<sup>24</sup>

In cases where a neurological disease manifests during pregnancy, especially if it is severe and progresses rapidly, timely treatment is critical for safeguarding the lives of both the mother and the fetus. For individuals planning a pregnancy, routine pre-pregnancy examinations should include screening for vascular malformations, aneurysms, and other intracranial conditions. If these are detected, immediate interventions are necessary before pregnancy. As far as possible, pregnancy should be planned under feasible conditions, with ongoing obstetric evaluations conducted throughout the pregnancy period.

The study has some limitations. The study was of retrospective design and had a small sample, limited the credibility of the conclusions. However, the results highlighted the importance of taking the possibility of comorbid neurological disorders of pregnancy into consideration in cases of pregnant women reporting symptoms such as headache, dizziness, nausea, vomiting, and intermittent convulsions. Investigating reproductive health on maternal/placental/fetal triads and effect of neurological disorders of the mother would on fetal outcomes would enhance our understanding of neurological disorders in life span. However, these were not the focus of the study. Further study enrolling a large sample and investigating reproductive health on maternal/placental/fetal triads is needed.

## Conclusion

Though the retrospective study had a small sample, it was suggested that improving obstetric examinations for the pregnant women, ensuring timely detection and diagnosis of various comorbidities, and seeking assistance from relevant specialties as needed are crucial for planning and providing accurate and reasonable treatment. For pregnant women with hypertension, it is essential to administer antihypertensive treatment, monitor blood pressure regularly, and remain vigilant for signs of cerebrovascular accidents such as headaches, nausea, and vomiting. Magnetic resonance imaging before pregnancy is necessary for those who have headache occasionally. In cases of pregnant women reporting symptoms such as headache, dizziness, nausea, vomiting, and intermittent convulsions, the possibility of comorbid neurological disorders of pregnancy must also be taken into account. Preventive measures for minimizing neurological disorders during pregnancy are critical to reduce adverse outcomes for both mothers and infants.

## Abbreviations

O-D, onset to diagnosis; HELLP, hemolysis, elevated liver enzymes, and low platelets; PRES, Posterior reversible encephalopathy syndrome.

## Data Sharing Statement

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

## Ethics Approval and Consent to Participate

This study was conducted with approval from the Ethics Committee of the First Affiliated Hospital of Xinjiang Medical University. This study was conducted in accordance with the declaration of Helsinki. Informed consent is not required for this study because it is a retrospective study. However, anonymized data analysis was conducted for the article only with good confidentiality.



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## Disclosure

The authors declare that they have no competing interests in this work.

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