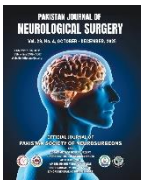

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Original Research

Evaluation of Seizure Disorders in Eclamptic and Pre-Eclamptic Patients: A Prospective Analysis from a Tertiary Care Hospital

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ABSTRACT

Objective: To evaluate the types, frequency, and clinical presentations of seizures in patients with eclampsia and preeclampsia, assess neuroimaging findings, including the prevalence of Posterior Reversible Encephalopathy Syndrome (PRES) and other cerebral abnormalities, and analyze maternal and fetal outcomes in relation to seizure characteristics and treatment strategies.

Materials & Methods: This prospective observational study was conducted at the Department of Obstetrics and Gynecology in collaboration with Neurology at Lady Reading Hospital, Peshawar, from January 2024 to June 2025. A total of 134 patients with eclampsia or severe preeclampsia presenting with seizures were enrolled. Clinical data, seizure type, imaging findings, treatment details, and maternal fetal outcomes were documented. The chi-square and logistic regression tests were applied for outcome associations' assessments.

Results: Of the 134 patients 70.1 percent had eclampsia and 29.9 percent had preeclampsia with seizures Generalized tonic clonic seizures were observed in 88.8 percent focal seizures in 8.2 percent and status epilepticus in 3 percent Neuroimaging was performed in 63.4 percent of patients revealing PRES in 36.5 percent Magnesium sulfate was administered in 96.3 percent ICU admission was required in 24.6 percent and maternal mortality was 3.7 percent Intrauterine fetal demise occurred in 13.4 percent and NICU admission was needed in 16.4 percent of neonates.

Conclusion: Seizures in hypertensive pregnancies are predominantly generalized and associated with PRES Early clinical and imaging assessment with prompt magnesium sulfate administration is essential to improve maternal and fetal outcomes.

Keywords: Eclampsia, Pre-eclampsia, Seizures, Magnesium sulfate, Maternal outcomes, Fetal outcomes, Neuroimaging.

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INTRODUCTION

Hypertensive disorders of pregnancy (HDP) remain among the foremost causes of maternal and perinatal morbidity and mortality worldwide, particularly in low- and middle-income countries such as Pakistan.[1] Of these, pre-eclampsia and eclampsia represent the most severe clinical entities, often leading to catastrophic complications if not recognized and managed promptly. According to the World Health Organization, complications from eclampsia and pre-eclampsia are responsible for approximately 76,000 maternal deaths and over 500,000 fetal deaths globally each year, with the greatest burden seen in resource-constrained settings.[2]

Pre-eclampsia is defined as new-onset hypertension (≥140/90 mmHg) with proteinuria (≥300 mg in 24 hours) or other signs of end-organ dysfunction after 20 weeks of gestation in a previously normotensive woman.[3] Eclampsia, the most serious complication of pre-eclampsia, involves the occurrence of new-onset generalized tonic-clonic seizures that cannot be attributed to other neurological causes. These seizures may occur before, during, or after delivery, with the postpartum period presenting a particular diagnostic challenge due to the lack of overt hypertensive signs in some patients.[4]

Despite the clinical significance of these conditions, data on the neurological aspects of eclampsia and pre-eclampsia, particularly seizure characteristics, neuroimaging findings, and their relationship with maternal outcomes, remain scarce in the South Asian context.[5] Most existing studies are retrospective in nature, with limited prospective data available to inform local clinical practice or policymaking. Given this gap, a prospective investigation allows for systematic documentation of seizure events, imaging findings, and therapeutic interventions as they occur, providing richer and more accurate insights into the clinical trajectory of affected women.[6]

Seizures in pre-eclampsia and eclampsia are most commonly generalized tonic-clonic in nature and can be sudden, recurrent, and life-threatening. These seizure episodes not only pose immediate risks such as aspiration, trauma, or prolonged hypoxia but also carry potential long-term neurological consequences if inadequately managed.[7] Furthermore, seizures occurring in the setting of pre-eclampsia may not always be attributable solely to the hypertensive disorder; conditions such as posterior reversible encephalopathy syndrome (PRES), cerebral venous sinus thrombosis, intracranial hemorrhage, or ischemic infarction must be considered, particularly when seizures are prolonged, focal, or resistant to first-line therapy.

One of the most frequently encountered neuroimaging abnormalities in eclampsia-related seizures is PRES, a vasogenic edema pattern most prominently affecting the parieto-occipital regions. PRES is typically reversible if promptly diagnosed and treated, but delayed recognition may result in irreversible damage or maternal death.[7] This highlights the importance of incorporating brain imaging, particularly magnetic resonance imaging (MRI), into the clinical evaluation of patients with atypical or recurrent seizures during pregnancy. However, in many tertiary care hospitals in Pakistan, including ours, imaging is often reserved for severe cases due to logistical and financial constraints, leading to underreporting of structural abnormalities.[8]

From a pathophysiological standpoint, eclampsia-related seizures are believed to result from endothelial dysfunction, loss of cerebral autoregulation, and capillary leakage, which together culminate in cerebral edema and hyperexcitability.[9] The breakdown of the blood-brain barrier and release of vasoactive substances further propagate seizure activity. These mechanisms may be influenced by gestational age, parity, severity of hypertension, coexisting infections, and genetic predisposition factors that are often underexplored in regional literature.[10]

The cornerstone of seizure management in eclampsia is magnesium sulfate, which has

consistently shown superior efficacy over diazepam or phenytoin in controlling and preventing recurrent seizures. The Magpie Trial and subsequent studies have firmly established magnesium sulfate as the first-line agent in both the prophylaxis and treatment of eclamptic seizures.[11] Its mechanism involves blocking NMDA receptors, stabilizing neuronal membranes, and inducing vasodilation, thereby reducing cerebral edema. Nonetheless, questions remain regarding optimal dosing protocols, therapeutic monitoring, and its role in atypical seizures.

The maternal and perinatal outcomes associated with seizure disorders in pregnancy are profound. On the maternal side, seizures may lead to ICU admission, mechanical ventilation, aspiration pneumonia, pulmonary edema, acute kidney injury, disseminated intravascular coagulation (DIC), or even mortality. Fetal outcomes are similarly poor in severe cases, with increased risks of intrauterine growth restriction (IUGR), preterm birth, stillbirth, and low Apgar scores. Understanding these complications in the context of real-time clinical data is essential to improving both immediate and long-term outcomes.

The prospective nature of this study is a key strength. Unlike retrospective designs that rely on incomplete or inconsistent records, a prospective approach allows for active data collection, real-time clinical assessments, standardized seizure documentation, and prompt imaging, ensuring higher data fidelity. This methodology is particularly useful in a tertiary care setting like Lady Reading Hospital, where a high volume of obstetric patients provides a rich source of clinical data. Furthermore, close collaboration between the departments of obstetrics, neurology, and radiology has enabled a multidisciplinary evaluation of patients, which enhances diagnostic accuracy and treatment outcomes.

To date, there are limited prospective studies in Pakistan that have systematically evaluated the clinical spectrum of seizure disorders in hypertensive pregnancies, including the role of neuroimaging and seizure type classification. This limits the development of context-specific guidelines and hampers efforts to train healthcare providers in early recognition and triage. Additionally, given the regional variations in access to care, cultural beliefs, and antenatal follow-up, a prospective study provides an opportunity to explore socio-demographic and clinical risk factors unique to this population.

The primary objectives of this prospective study are threefold. First, the study aims to evaluate the types, frequency, and clinical presentations of seizures occurring in patients diagnosed with eclampsia and pre-eclampsia, thereby providing a detailed understanding of seizure patterns in this high-risk obstetric population. Second, the study seeks to assess the neuroimaging findings, with particular emphasis on identifying the presence, distribution, and severity of posterior reversible encephalopathy syndrome (PRES) and other relevant cerebral pathologies through MRI and CT scans. Third, the study intends to analyze maternal and fetal outcomes in relation to the seizure characteristics and the therapeutic strategies employed, including the use of magnesium sulfate and other supportive measures. Together, these objectives aim to enhance the early recognition, diagnosis, and multidisciplinary management of seizure disorders in hypertensive pregnancies within a tertiary care setting.[12]

By focusing on these dimensions, this study hopes to fill a critical gap in the literature and provide evidence-based recommendations for the clinical management of eclamptic and pre-eclamptic seizures in resource-constrained environments. The findings are anticipated to contribute toward national guidelines and training modules, with an emphasis on early warning signs, imaging criteria, and interdepartmental coordination.

In summary, seizure disorders in pre-eclamptic and eclamptic patients represent a complex

interplay of neurological and obstetric emergencies. Their evaluation requires not only a timely clinical response but also a deeper understanding of the underlying pathophysiology, imaging correlates, and outcome predictors. Through this prospective study, we aim to generate robust, locally relevant evidence that can enhance clinical practice, improve patient outcomes, and reduce the high maternal and perinatal burden associated with these disorders in Pakistan.

MATERIALS AND METHODS

Study Population and Setting

This prospective observational study was conducted at the Department of Obstetrics and Gynecology, in collaboration with the Department of Neurology, at Lady Reading Hospital, Peshawar, a tertiary care public teaching institution. The study period extended from January 2024 to June 2025, during which patients fulfilling the eligibility criteria were enrolled and followed through their clinical course.

Inclusion Criteria

The study included women aged 18 years and above who were diagnosed with either pre-eclampsia or eclampsia and presented with new-onset seizures during the antenatal, intrapartum, or immediate postpartum period (within 7 days of delivery). Only patients with complete clinical records and a willingness to participate (or whose legal attendants consented in emergencies) were considered for inclusion.

Exclusion Criteria

Patients were excluded if they had a known diagnosis of epilepsy or any other chronic seizure disorder before the current pregnancy. Those with identifiable non-obstetric causes of seizures, such as intracranial infections, space-occupying lesions, or recent head trauma, were also excluded. Additionally, patients with incomplete data, unavailability for follow-up, or refusal to participate were not enrolled.

Data Collection

A structured data collection form was used to gather relevant clinical, imaging, and outcome data for each patient. Demographic variables included age, parity, and gestational age at seizure onset. Clinical variables comprised the type of hypertensive disorder (pre-eclampsia or eclampsia), blood pressure readings, presence of proteinuria, number and type of seizures (generalized, focal, or status epilepticus), timing of seizures (antepartum, intrapartum, or postpartum), level of consciousness, and Glasgow Coma Scale (GCS) score at presentation. Laboratory investigations reviewed included complete blood count (CBC), liver and renal function tests (LFTs, RFTs), serum magnesium levels, and urinalysis.

Neuroimaging, including CT or MRI of the brain, was performed in selected patients based on neurologic symptoms, seizure persistence, or atypical features. It was performed after initial stabilization, typically within 24–48 hours of seizure onset, in patients with atypical features, persistent seizures, or delayed neurological recovery. Radiologic assessment focused on identifying Posterior Reversible Encephalopathy Syndrome (PRES), infarctions, hemorrhage, or other structural pathologies. Imaging findings were reviewed by consultant radiologists and confirmed by neurologists.

Management details such as the use of magnesium sulfate, antihypertensive medications, need for ICU admission, mechanical ventilation, and involvement of neurology services were documented. Follow-up during hospital stay included monitoring of seizure recurrence, hemodynamic status, and treatment response.

Maternal and Fetal Outcomes

Maternal outcomes assessed included duration of hospital stay, need for intensive care, development of complications such as pulmonary edema, acute kidney injury, or aspiration pneumonia, and maternal mortality. Fetal and neonatal outcomes included intrauterine fetal demise (IUFD), Apgar scores, birth weight, and requirement for NICU admission.

Ethical Approval

Ethical clearance was obtained from the Institutional Review Board of Lady Reading Hospital, and all procedures followed the ethical standards for research involving human participants. Confidentiality of patient information was strictly maintained, and informed consent was taken wherever applicable.

Statistical Analysis

All data were entered and analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables such as age, systolic/diastolic blood pressure, and seizure frequency were expressed as means with standard deviations. Categorical variables such as type of seizures, imaging findings, and outcome categories were presented as frequencies and percentages. Associations between clinical variables and outcomes were evaluated using the Chi-square test or Fisher's exact test as appropriate. A p-value <0.05 was considered statistically significant. Binary logistic regression analysis was also performed to identify independent predictors of adverse maternal outcomes.

RESULTS

Patient Demographics and Clinical Distribution

A total of 134 patients with seizure episodes associated with hypertensive disorders of pregnancy were included in the study. Among these, 94 patients (70.1%) were diagnosed with eclampsia, while 40 patients (29.9%) had severe pre-eclampsia complicated by new-onset seizures. The mean age was 27.6 ± 4.9 years, and the mean gestational age at presentation was 35.2 ± 2.6 weeks. The majority of patients were primigravida (n = 84; 62.7%). Seizures occurred most frequently in the antepartum period (58.2%), followed by intrapartum (21.6%) and postpartum (20.2%) phases.

Table 1: *Clinical Characteristics of the Study Population (n = 134).*

Parameter	Frequency (%) or Mean ± SD
Age (years)	27.6 ± 4.9
Gestational age (weeks)	35.2 ± 2.6
Primigravida	84 (62.7%)
Eclampsia	94 (70.1%)
Pre-eclampsia with seizures	40 (29.9%)
Antepartum seizures	78 (58.2%)
Intrapartum seizures	29 (21.6%)
Postpartum seizures	27 (20.2%)

Seizure Characteristics

Generalized tonic-clonic seizures were observed in 119 patients (88.8%), whereas 11 patients (8.2%) experienced focal seizures. Status epilepticus was documented in 4 patients (3%). The mean number of seizures before initiation of treatment was 2.3 ± 1.1.

Neuroimaging Findings

Neuroimaging was performed in 85 patients (63.4%). Among these, posterior reversible encephalopathy syndrome (PRES) was identified in 31 cases (36.5%). Additional findings included cerebral infarctions in 9 patients (10.6%), intracerebral hemorrhage in 5 patients (5.9%), while 40 patients (47.1%) had normal imaging findings.

Management and Interventions

Magnesium sulfate was administered to 129 patients (96.3%) as the first-line anticonvulsant. A small subset (n = 9; 6.7%) required additional agents such as lorazepam or phenytoin due to seizure recurrence or status epilepticus. All patients received antihypertensive therapy. ICU admission was necessary in 33 patients (24.6%), and mechanical ventilation was required in 11 patients (8.2%) due to respiratory compromise or persistent altered mental status.

Table 2: *Seizure Type and Neuroimaging Findings.*

Variable	Frequency (%)
Generalized tonic-clonic seizures	119 (88.8%)
Focal seizures	11 (8.2%)
Status epilepticus	4 (3%)
Imaging performed	85 (63.4%)
PRES on MRI	31 (36.5% of imaged cases)
Infarction	9 (10.6%)
Intracerebral hemorrhage	5 (5.9%)
Normal imaging	40 (47.1%)

Maternal and Fetal Outcomes

Maternal complications occurred in 41 patients (30.6%), the most common being pulmonary edema (10.4%), acute kidney injury (6.7%), and aspiration pneumonia (5.2%). The maternal mortality rate was 3.7% (5 patients), primarily due to status epilepticus, cerebral hemorrhage, or multi-organ failure.

Fetal outcomes included intrauterine fetal demise (IUFD) in 18 cases (13.4%). A total of 22 neonates (16.4%) were admitted to the NICU for birth asphyxia, low birth weight, or prematurity. The mean birth weight was 2.41 ± 0.53 kg, and low Apgar scores (<7 at 5 minutes) were recorded in 29 newborns (21.6%).

Table 3: *Maternal and Fetal Outcomes.*

Outcome	Frequency (%)
ICU admission	33 (24.6%)
Mechanical ventilation	11 (8.2%)
Pulmonary edema	14 (10.4%)
Acute kidney injury	9 (6.7%)
Aspiration pneumonia	7 (5.2%)
Maternal mortality	5 (3.7%)
Intrauterine fetal demise (IUFD)	18 (13.4%)
NICU admission	22 (16.4%)
Low Apgar score (<7 at 5 min)	29 (21.6%)
Mean birth weight (kg)	2.41 ± 0.53

Statistical Analysis

Comparative analysis revealed that patients who experienced maternal complications were more likely to have PRES on neuroimaging (p = 0.031), status epilepticus (p = 0.022), and required ICU admission (p < 0.001). The presence of PRES was significantly associated with prolonged seizure activity and delayed recovery. Focal seizures were not significantly associated with poor maternal outcomes (p = 0.276). Similarly, patients requiring mechanical ventilation had a significantly higher risk of mortality (p = 0.004).

Table 4: *Association of Clinical Variables With Maternal Complications (n = 134).*

Variable	With Complications (n = 41)	Without Complications (n = 93)	p-value
PRES on imaging	18 (43.9%)	13 (13.9%)	0.031*
Status epilepticus	3 (7.3%)	1 (1.1%)	0.022*
ICU admission	26 (63.4%)	7 (7.5%)	<0.001*
Mechanical ventilation	9 (22%)	2 (2.1%)	0.004*
Focal seizures	4 (9.8%)	7 (7.5%)	0.276

*Significant at p < 0.05

DISCUSSION

The current study provides a prospective analysis of seizure disorders in patients with eclampsia and pre-eclampsia within a tertiary care setting in Pakistan.[13] This analysis highlights the clinical characteristics, imaging findings, maternal outcomes, and fetal complications associated with

seizures in hypertensive pregnancies. It also emphasizes the importance of early neurological assessment, imaging, and standardized management in improving patient outcomes. The study draws attention to critical clinical patterns and risk indicators that may guide clinicians in high-risk obstetric care.[14]

Eclampsia and pre-eclampsia remain significant contributors to maternal and perinatal morbidity and mortality, particularly in resource-constrained environments. The majority of patients in this study were diagnosed with eclampsia rather than pre-eclampsia, which is consistent with the clinical observation that seizures are more prevalent in the former. The average maternal age was below thirty years, and most patients were primigravida, supporting the notion that first-time pregnancies are at increased risk. These demographic features are important in designing antenatal screening strategies and public health campaigns for early detection and intervention.[15]

The clinical distribution of seizure onset showed that the antepartum period carried the highest risk, followed by the intrapartum and postpartum phases. This distribution suggests that antenatal monitoring should be intensified during the third trimester, especially among women with elevated blood pressure or proteinuria. Postpartum seizures, although less frequent, are particularly concerning due to the risk of delayed diagnosis and potential for overlooking neurological deterioration after delivery.[16]

Generalized tonic-clonic seizures were by far the most common seizure type observed in this study. This pattern is typical in eclampsia and is considered a hallmark of the condition. However, a notable number of patients also experienced focal seizures, and a small subset developed status epilepticus.[17] These findings highlight the need for clinicians to consider differential neurological diagnoses in cases of atypical presentations. Status epilepticus, although rare, was significantly associated with adverse maternal outcomes, including ICU admission, mechanical ventilation, and death. This underscores the importance of immediate seizure control and close monitoring in patients with prolonged or refractory convulsions.[18]

Neuroimaging played a critical role in evaluating patients with persistent seizures, altered mental status, or incomplete recovery. Among the patients who underwent imaging, a considerable proportion showed evidence of posterior reversible encephalopathy syndrome. [19] This condition is characterized by vasogenic edema and often manifests with seizures, headaches, and visual disturbances. The presence of PRES was significantly associated with maternal complications in the current study. This correlation confirms the value of MRI or CT imaging in patients with eclampsia who exhibit severe or atypical symptoms. Identifying PRES early allows clinicians to tailor management strategies and prevent progression to irreversible neurological damage.[20]

Other imaging findings included infarctions and intracerebral hemorrhages, both of which were observed in a minority of patients. These conditions are severe and often linked to poor outcomes. Their detection further highlights the utility of neuroimaging in ruling out life-threatening complications in pregnant women with seizures. While normal imaging was found in nearly half of the cases, the presence of radiologic abnormalities in the remainder justifies the selective use of imaging in patients with neurological symptoms that extend beyond isolated seizures.[21]

Magnesium sulfate remained the first-line agent for seizure control and was administered to the vast majority of patients. It is effective, safe, and widely recommended for the prevention and treatment of eclamptic seizures. In a few patients with recurrent seizures or status epilepticus, additional medications such as lorazepam or phenytoin were used. These cases point to the need for protocol-based escalation strategies when first-line therapy does not yield adequate control. Standardizing such protocols ensures that

patients receive timely and appropriate care, thereby minimizing the risks of cerebral hypoxia, aspiration, and systemic deterioration.[22]

ICU admission was required in approximately one-fourth of patients, and mechanical ventilation in less than ten percent. These figures reflect the severity of illness in certain patients and the need for high-dependency care in selected cases. The ability to escalate care within a tertiary setup is essential for managing critical obstetric emergencies. Hospitals lacking such facilities may face higher mortality due to delays in referral and inadequate supportive care.[23]

Maternal complications were common and included pulmonary edema, acute kidney injury, and aspiration pneumonia. These complications often result from prolonged seizures, hemodynamic instability, or secondary infections. Pulmonary edema may be related to fluid overload, impaired cardiac function, or systemic inflammation. Acute kidney injury reflects underlying endothelial dysfunction, reduced perfusion, or nephrotoxicity. Aspiration pneumonia is frequently seen in patients with status epilepticus and altered consciousness. Together, these findings emphasize the systemic nature of eclamptic seizures and the need for multidisciplinary management involving obstetricians, neurologists, intensivists, and nursing staff.

The maternal mortality rate in the study was under five percent, which, although low, is still clinically significant. Deaths were primarily attributed to refractory seizures, cerebral hemorrhage, and multi-organ failure. These outcomes reinforce the importance of early recognition, aggressive stabilization, and referral to tertiary care centers equipped to handle such emergencies. Education and training of healthcare personnel in peripheral settings should focus on recognizing danger signs and initiating immediate magnesium sulfate therapy while arranging for urgent transfer.

Fetal outcomes in this study were also notable. Intrauterine fetal demise occurred in over ten percent of cases, while NICU admissions were required in more than fifteen percent. Low Apgar scores and low birth weight were also prevalent. These outcomes are influenced by a range of factors, including maternal hypoxia, placental insufficiency, prematurity, and systemic inflammation. Early maternal stabilization plays a crucial role in improving fetal survival and reducing neonatal morbidity. Antenatal corticosteroids for fetal lung maturity, timely delivery planning, and skilled neonatal resuscitation are additional factors that contribute to better outcomes.

The statistical analysis revealed several variables that were significantly associated with maternal complications. These included the presence of PRES status epilepticus, ICU admission, and mechanical ventilation. These associations confirm that certain clinical features can serve as predictors of poor prognosis. The identification of such indicators allows clinicians to stratify risk and allocate resources more effectively. Patients with such features should be prioritized for high-level monitoring and early intervention to reduce preventable morbidity and mortality.

One important finding was that focal seizures were not significantly associated with adverse maternal outcomes. This suggests that while focal seizures are less typical in eclampsia, they may not independently predict complications. Nevertheless, focal seizures still warrant neuroimaging and neurologic evaluation to exclude alternative etiologies. Their presence should prompt a detailed assessment, especially in the absence of overt hypertension or proteinuria.

This prospective study adds to the growing evidence that a structured approach to seizure disorders in pregnancy leads to better identification of complications and facilitates timely management. The findings support the integration of neuro-obstetric care, particularly in high-risk units. The selective use of imaging, close neurological monitoring, and evidence-based treatment protocols form the foundation of

effective management. Training frontline providers in these principles is essential for extending quality care to underserved areas.

CONCLUSION

This study underscores the complex interplay between hypertensive disorders of pregnancy, seizure activity, and maternal-fetal outcomes. The findings demonstrate that early diagnosis, targeted imaging, individualized treatment, and multidisciplinary care are critical in reducing the burden of eclampsia and its neurologic manifestations. Policymakers and hospital administrators must invest in training infrastructure and equipment that support rapid response to obstetric emergencies. Only through such coordinated efforts can maternal and neonatal outcomes be improved in resource-limited settings.

LIMITATIONS

This study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other healthcare settings. Neuroimaging was selectively performed based on clinical criteria rather than uniformly across all patients, which may have led to underestimation of radiologic abnormalities. Long-term neurological follow-up was not included, so delayed cognitive or functional deficits could not be assessed. Additionally, fetal outcomes were limited to immediate postnatal parameters without long-term developmental evaluation.

RECOMMENDATIONS

Routine neurological evaluation should be integrated into the management of all patients presenting with eclampsia or atypical seizures during pregnancy. Neuroimaging should be considered early in cases with prolonged altered sensorium or focal deficits to detect reversible conditions like PRES. Protocol-based use of magnesium sulfate and structured escalation to second-line therapies should be implemented across all levels of care. Training of peripheral health staff in seizure recognition and immediate stabilization is essential. Future multicenter studies with long-term follow-up are recommended to better assess maternal and neonatal outcomes.

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Disclosure Statements

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Informed Consent: Written informed consent was obtained from all participants before inclusion in the study.
Data Availability: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

AUTHOR CONTRIBUTION TABLE

Author Name	Contribution
Saira Khan	Study conception, patient management, data collection, manuscript drafting
Nadia	Literature review, result interpretation, and critical revision of the manuscript
Qurat ul Ain	Data analysis, formatting, and final manuscript approval
Amna Khalil	Statistical analysis, reference validation, and editing support