



NEUROLOGICAL DISEASES IN PREGNANCY: CLINICAL PROFILE, ETIOLOGY, AND FETO-MATERNAL OUTCOME

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ABSTRACT

Background: Pregnancy modifies the presentation and course of neurological disease, and neurological illness in turn affects maternal and fetal wellbeing. Data on this interaction from the Indian subcontinent remain limited.

Objectives: To study the clinical presentation, etiology, and maternal and fetal outcomes of neurological disease complicating pregnancy and the puerperium.

Methods: This prospective observational study was conducted at a tertiary care centre from November 2022 to May 2024. Sixty pregnant or puerperal women with neurological symptoms or signs were enrolled after informed consent. Patients with classical pre-eclampsia/eclampsia without focal neurodeficit, non-organic neurological complaints, and hepatic or uremic encephalopathy were excluded. Detailed clinical evaluation, laboratory work-up, neuroimaging, and electrophysiological testing were performed as indicated, and patients were followed for 42 days postpartum. Associations were tested using the chi-square or Fisher's exact test, with $p < 0.05$ considered significant.

Results: The mean age was 23.8 years; 62% were primigravida and 62% presented postnatally. The commonest presenting features were headache (83%), seizures (73%) and altered sensorium (65%). Posterior reversible encephalopathy syndrome (PRES) was the leading diagnosis (36.7%), followed by cerebral venous sinus thrombosis (CVST, 33.3%); arterial stroke, epilepsy and CNS infections accounted for the remainder. PRES was significantly associated with primigravida status (77%, $p = 0.049$), antenatal presentation ($p = 0.049$), and pregnancy-induced hypertension (77%, $p < 0.001$), and required more frequent preterm delivery (55%, $p = 0.033$) and caesarean section (55%, $p = 0.033$); neurological recovery was excellent (95.5% full recovery, $p = 0.012$) but fetal morbidity was high (68% low birth weight). CVST occurred with equal frequency in primigravida and multigravida, was significantly more common postpartum (90%, $p = 0.002$), and showed no association with pregnancy-induced hypertension. Overall maternal mortality was 11.7% and fetal loss was 20%; low birth weight affected 50% of surviving infants.

Conclusion: PRES and CVST together account for the majority of pregnancy-associated neurological disease in this population, each with a distinct clinico-demographic signature. Early recognition — guided by presenting symptoms, timing relative to delivery, and blood pressure status — allows timely imaging and intervention, improving maternal recovery, though fetal morbidity remains substantial.

Keywords: Pregnancy, Neurological Disease, Posterior Reversible Encephalopathy Syndrome, Cerebral Venous Sinus Thrombosis, Stroke, Epilepsy, Maternal Outcome, Fetal Outcome.

INTRODUCTION

Pregnancy adds a distinctive dimension to the management of neurological disease. The gravid state can alter the course of pre-existing conditions such as epilepsy, myasthenia gravis and myotonic dystrophy, while new neurological disorders — ranging from generally benign peripheral nerve and

muscle syndromes to rare but life-threatening central nervous system disease — may arise de novo during gestation or the puerperium.(1) In every instance, the presence of the fetus constrains diagnostic and therapeutic choices: imaging is used cautiously, many drugs are relatively contraindicated, and patient preference weighs heavily on decision-making.

The neurological disorders most characteristic of this period include eclampsia, posterior reversible encephalopathy syndrome (PRES), cerebral venous sinus thrombosis (CVST), and ischemic or hemorrhagic stroke, all of which share hypertensive and prothrombotic mechanisms unique to pregnancy.(2) Pregnancy also modifies the course of epilepsy and migraine, and predisposes to



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compressive mononeuropathies such as carpal tunnel syndrome and meralgia paresthetica through fluid retention and mechanical factors.(3) Because pregnant women are, appropriately, under-represented in clinical trials, high-quality outcome data remain scarce, and clinicians must rely largely on history, examination, and observational registries.(4)

The neurological complications most characteristic of the peripartum period demonstrate significant heterogeneity in presentation and outcome.(5) Eclampsia remains the leading cause of pregnancy-related seizures, yet PRES and CVST account for substantial morbidity and mortality in obstetric populations.(1,6) Hypertensive disorders of pregnancy are particularly important drivers of both acute neurological emergencies and long-term neurological sequelae, with recent evidence linking them to elevated postpartum risks of migraine, headache, epilepsy, and other neurological conditions.(6)

This study was undertaken to characterise the clinical presentation, etiological spectrum, and feto-maternal outcomes of neurological disease complicating pregnancy at a tertiary referral centre, and to compare these findings against other published Indian and international series.

MATERIALS AND METHODS

This prospective observational study was conducted in the department of a tertiary care hospital between November 2022 and May 2024. Sixty pregnant or puerperal women presenting with neurological symptoms and/or signs, or with eclampsia accompanied by a focal neurological deficit, were enrolled after informed consent. Women with classical pre-eclampsia/eclampsia without focal neurodeficit, non-organic neurological complaints, or hepatic/uremic encephalopathy were excluded. Each patient underwent a detailed history (with emphasis on presenting symptoms and obstetric history) and clinical examination. Investigations

included complete hemogram and peripheral smear, urine microscopy, renal and liver function tests, coagulation profile (bleeding/clotting time, prothrombin time, aPTT, platelet count, antiphospholipid antibodies, protein C and S, factor V Leiden, homocysteine, D-dimer, fibrinogen), serum calcium and magnesium where indicated, HIV/HBsAg/VDRL serology, leptospira IgM and Widal test where relevant, CSF analysis, ECG and 2D-echocardiography, and imaging (chest X-ray, ultrasonography, Doppler, CT and/or MRI brain) together with EEG, nerve conduction studies and electromyography as clinically indicated.

A final etiological diagnosis was reached by integrating clinical course, laboratory results and neuroimaging, and patients were followed until 42 days postpartum for maternal and fetal outcome. Statistical analysis was performed using jamovi; associations between outcome and clinical parameters were tested using the chi-square test or Fisher's exact test (for expected cell frequency <5), with $p < 0.05$ taken as significant.

RESULTS

Baseline Characteristics

The mean age of the 60 patients was 23.8 years (range 18–36), with 48.3% aged between 21 and 25 years. Sixty-two percent were primigravida. Thirty-eight percent of patients presented antenatally (ANC) and 62% postnatally (PNC).

Presenting Features

Headache (83.3%), seizures (73.3%), altered sensorium (65.0%), vomiting (50.0%) and visual disturbance (30.0%) were the leading presenting symptoms (Table 1). A history of pregnancy-induced hypertension (PIH) was present in 43% of patients. On general examination, pedal edema (51.7%), pallor (46.7%), and hypertension (43.3%) were the commonest findings; bradycardia, seen in 18.3%, correlated with raised intracranial tension in patients with CVST, intracerebral bleed and encephalitis.

Table 1. Presenting Symptoms (N=60)

Symptom	N	%
Headache	50	83.3
Seizures	44	73.3
Altered Sensorium	39	65.0
Vomiting	30	50.0
Visual Disturbance	18	30.0
Bowel/Bladder Abnormality	17	28.3
Motor Weakness	15	25.0
Fever	13	21.7

Neurological Examination and Investigations

Altered sensorium at admission precluded formal assessment of higher mental functions, orientation, memory and speech in 57–65% of patients. Among those assessable, reflexes were abnormal in 57% and

motor examination abnormal in 27%. Papilledema was noted in 36.7% of patients, indicating raised intracranial tension, and meningeal signs were present in 17%.

Hemogram was abnormal in 61.7% (predominantly anaemia), urinalysis showed albuminuria in 60%, and renal and liver function were deranged in 5.0% and 6.7%, respectively. Among 20 patients with CVST who underwent thrombophilia work-up, serum homocysteine was raised in 15% and protein C/S deficiency was found in 23%. CT brain, performed in 32 patients, was abnormal in all; MRI, performed in 33, was abnormal in 84.8%.

Final Diagnosis

PRES was the most common diagnosis, accounting for 22 patients (36.7%), followed by CVST in 20

patients (33.3%). Ischemic and hemorrhagic stroke together accounted for 5 patients (8.3%), epilepsy for 3 (5.0%), and CNS infections (meningitis, encephalitis, neurocysticercosis, subacute sclerosing panencephalitis) for 4 (6.7%). The remaining diagnoses — hypokalemic periodic paralysis, subdural and subarachnoid hemorrhage, post-lumbar-puncture headache, cerebral edema, and Wernicke's encephalopathy — occurred singly (Table 2).

Table 2. Final Diagnosis Distribution (N=60)

Diagnosis	N	%
PRES	22	36.7
CVST	20	33.3
CNS Infections (Meningitis, Encephalitis, NCC, SSPE)	4	6.7
Ischemic Stroke	3	5.0
Epilepsy	3	5.0
Hemorrhagic (Intracerebral) Stroke	2	3.3
Other Single Diagnoses (HPP, SDH, SAH, Post-LP Headache, Cerebral Edema, Wernicke's Encephalopathy)	6	10.0
Total	60	100.0

PRES

Twenty-two patients (mean age 23.1 years) were diagnosed with PRES, all after exclusion of eclampsia without focal deficit. PRES was significantly more frequent in primigravida (77.3% vs 22.7%, $p=0.049$) and in the antenatal period (54.5%, $p=0.049$). Seizures (100%), headache (95.4%) and visual disturbance (68.1%) were the leading symptoms; pedal edema (81.8%) and hypertension (77.2%) were the leading signs. PIH was present in 77% of PRES patients, a strong and statistically significant association ($p<0.001$). Preterm delivery (54.5%, $p=0.033$) and caesarean section (54.5%, $p=0.033$) were both significantly more frequent in this group. Complete neurological recovery occurred in 95.5% ($p=0.012$) with no maternal deaths, but fetal outcome was poor: only 13.6% of babies were of normal birth weight, 68.2% were low birth weight, and total fetal loss was 18.2%.

CVST

Twenty patients (33.3% of the cohort, and 80% of all stroke — arterial and venous — excluding SAH/SDH) were diagnosed with CVST, occurring with equal frequency in primigravida and multigravida. CVST was significantly more common in the postpartum period (90%, $p=0.002$) and showed no significant association with PIH, which was present in only 20% of cases ($p=0.010$). Headache (95%), vomiting (75%), and seizures/altered sensorium (60% each) were the leading symptoms; pallor (85%) and bradycardia (45%) were the leading signs, and papilledema was noted in 60%. Most patients (65%) delivered at

term, predominantly vaginally (70%). Complete recovery occurred in 70%, partial recovery (residual hemiparesis, aphasia, or depression) in 15%, and death in 15% — the highest case-fatality of any diagnostic category in the series. Fetal outcome showed 45% normal, 35% low birth weight, and 20% total fetal loss.

Stroke, Epilepsy and Other Diagnoses

Three cases of ischemic stroke were recorded (mean age 27 years); two ended in maternal death (one large left MCA infarct, one associated with HELLP syndrome) and one recovered fully. Two cases of hemorrhagic stroke occurred: one fatal intracerebral bleed in a primigravida with PIH, and one non-fatal corpus callosum hematoma presenting with paraparesis.

All three epilepsy patients were known cases on antiepileptic drug therapy; seizure frequency decreased during pregnancy in all three, none had PIH, and all delivered vaginally with seizures controlled throughout the puerperium; two of three infants were low birth weight.

Single cases of aseptic (leptospirosis) meningitis, hypokalemic periodic paralysis, subacute sclerosing panencephalitis, neurocysticercosis, non-traumatic subdural hematoma, post-lumbar-puncture headache, eclamptic cerebral edema, subarachnoid hemorrhage (with disseminated intravascular coagulation and intrauterine death), Wernicke's encephalopathy (associated with hyperemesis and low vitamin B12), and fatal septic encephalopathy following medical termination of pregnancy were also recorded, each managed on its individual merits.

Comparison with Other Studies

Table 3. Comparison with Other Published Series

Study (Year)	N	Commonest Diagnosis	Key Comparator Finding
Agarwal Et Al. (1971)	87	Stroke (82.7%)	Eclampsia Excluded; Arterial + Venous Stroke Combined
To WK Et Al. (1997)	161	Epilepsy (63.3%)	Eclampsia Included (11.8%)
Gupta Et Al. (2006)	76	Metabolic Encephalopathy (36.8%)	Epilepsy Second Commonest (28.9%)
Sarella Et Al. (2014)	55	Epilepsy (49.1%)	Eclampsia Second Commonest (20%)
Wagner Et Al. (2011)	13 (PRES)	—	Primigravida 61.5%; PIH 100%; Headache Commonest
Luiz Et Al. (2014)	18 (PRES)	—	Mean Age 25.8 Y; SBP >160 In 66.7%
Present Study (2015)	60	PRES (36.7%)	PRES + CVST = 70% Of Cohort

Overall Maternal and Fetal Outcome

At the end of the study period, full neurological recovery was achieved in 71.7% of patients, partial recovery (residual deficit) in 10.0%, seizure/movement control without full recovery in 6.7%, and death in 11.7% (7/60). Among those who died, 71.4% had a hospital stay of less than 7 days, compared with only 11.3% of survivors, suggesting that rapidly fatal presentations allowed little time for intervention.

Fetal outcome was normal in 30.0%, low birth weight in 50.0%, and there was fetal death (intrauterine death or neonatal death) in 15.0% and abortion in 5.0%, giving a total fetal loss of 20%. Preterm delivery was required in 35% of pregnancies overall, and caesarean section in 35% (18.3% preterm, 16.7% term).

DISCUSSION

This study identifies PRES and CVST as the two dominant neurological disorders complicating pregnancy in this population, together accounting for 70% of cases — a pattern that contrasts with several earlier Indian series in which epilepsy or metabolic encephalopathy predominated. Agarwal et al.(7) reported stroke (including both arterial and venous events) as the leading diagnosis (82.7%) that excluded eclampsia; when arterial and venous stroke are considered separately in the present cohort, they still account for 41.6% of cases. In contrast, To WK et al.(8) and Sarella et al.(9) found epilepsy to be the commonest cause (63.3% and 49.1% respectively), while Gupta et al.(10) reported metabolic encephalopathy as most frequent (36.8%). The divergence likely reflects differences in inclusion criteria — several of these series included eclampsia without neurodeficit, which was deliberately excluded here to isolate genuine focal or diffuse neurological disease — as well as referral patterns to a tertiary neurology unit.

PRES in this cohort showed a clinico-demographic profile consistent with international reports:

predominance in primigravida (77.3% here versus 61.5% reported by TH(11) et al., 2011), antenatal onset, and a strong association with pregnancy-induced hypertension (77% versus 100% reported by Spampinato et al.(12) and 66.7% with severe hypertension reported by Luiz et al.(13)). Seizures were the most frequent presenting symptom in this series (100%), whereas headache predominated in both comparator studies (92.3% and 88.9% respectively) — a difference that may reflect referral bias toward a neurology service. The near-universal neurological recovery (95.5%) without maternal mortality mirrors the fundamentally reversible pathophysiology of PRES — vasogenic oedema from impaired cerebral autoregulation in the setting of acute hypertension — but this benign maternal trajectory contrasted sharply with fetal outcome: 68.2% low birth weight and 18.2% total fetal loss, likely reflecting the frequent need for preterm delivery in the presence of severe hypertensive disease.

CVST in this study occurred equally in primigravida and multigravida, in keeping with Murali et al.(14), and was markedly more frequent postpartum (90%) than antenatally, consistent with Algahtani et al.(15) (71% postpartum), Murali et al.(14) (87.5% postpartum) and Gupta et al. (100% postpartum).(10) This postpartum predominance is attributed to the physiological hypercoagulable state of pregnancy — elevated fibrinogen and factors VII, VIII and X, falling protein S, rising protein C inhibitors, and increased heparin-neutralising capacity — which peaks around delivery. Headache was again the leading symptom across all comparator studies, though the frequency of associated features (vomiting, hemiplegia, altered sensorium) varied. Preeclampsia was present in a comparable minority of CVST patients across studies (20% here, 20–25% in comparator studies)(16), supporting the view that CVST and PRES/eclampsia are largely independent processes with different maternal risk profiles. The 15%

mortality observed here falls within the range reported elsewhere (16.7% by Algahtani et al., 4% by Gupta et al.)(10,15) and underscores that, despite a generally favourable prognosis with anticoagulation, CVST remains the leading cause of neurological maternal mortality in this study.

Stroke and epilepsy were comparatively uncommon in this study relative to some other Indian reports, likely reflecting case-mix at a tertiary neurology referral unit and the deliberate exclusion of eclampsia without neurodeficit. The two maternal deaths among five stroke cases highlight the disproportionate severity of arterial and hemorrhagic events compared with the venous and PRES-related pathology that dominated the cohort numerically. Epilepsy behaved favourably in this small sample, with a reduction in seizure frequency during pregnancy in all three patients, consistent with the general observation that roughly 40–50% of women with epilepsy experience no change and 20–30% improve during pregnancy; none had eclampsia-range hypertension, and outcomes were good for both mother and, in two of three cases, birth weight was reduced — a finding that echoes reports of increased low-birth-weight risk with antenatal antiepileptic drug exposure independent of malformation risk.

Several methodological points merit comment. First, deliberately excluding eclampsia without focal neurodeficit sharpens the diagnostic spectrum toward genuine neurological disease but limits direct comparability with series that include the full eclamptic spectrum. Second, small numbers in most diagnostic categories other than PRES and CVST limit the statistical power of subgroup comparisons — several associations reported as non-applicable reflect single-patient categories rather than a true absence of association. Third, this was a single-centre tertiary referral cohort, and referral bias toward more severe or diagnostically uncertain cases likely inflates both the proportion of PRES/CVST and the observed complication rates relative to a general obstetric population.

Overall, this study reinforces two clinically actionable patterns: an antenatal presentation with headache, seizures, and hypertension should prompt urgent consideration of PRES, with expectation of good neurological recovery if promptly managed; while a postpartum presentation with headache, vomiting, and a subacute course — even without hypertension — should prompt urgent imaging (preferably MR venography) for CVST, given its disproportionate contribution to maternal mortality in this setting.

CONCLUSION

Neurological disease in pregnancy is most common in the thirties, in primigravida, and in the postpartum period, presenting characteristically with headache,

seizures and altered sensorium, often in association with hypertension and anemia. PRES is the single commonest disorder, particularly in primigravida during the antenatal period and in the presence of pregnancy-induced hypertension; it carries an excellent maternal neurological prognosis but a high risk of fetal morbidity and mortality. CVST is the second commonest disorder, occurring with equal frequency across parity, predominantly in the postpartum period, independent of hypertensive status, and carries the highest case-fatality in this cohort despite an overall favourable recovery rate. Stroke, epilepsy and CNS infections are comparatively uncommon but individually consequential. Prompt recognition of these distinct clinical patterns, supported by targeted neuroimaging and thrombophilia work-up, is essential to optimising both maternal and fetal outcomes.

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