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Original Research Article

A STUDY OF NEUROLOGICAL DISORDERS IN PREGNANCY AND PUERPERIUM IN A TERTIARY CARE HOSPITAL IN NORTH INDIA

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ABSTRACT

Background: Neurological disorders during pregnancy and puerperium are a major cause of maternal morbidity and mortality, influenced by infections, vascular events, systemic illnesses. Limited awareness, socioeconomic barriers, and diagnostic delays further complicate outcomes. This study aimed to evaluate the spectrum, imaging findings, outcomes of neurological disorders among pregnant and postpartum women in a tertiary care centre in North India. **Materials and Methods:** A hospital-based cross-sectional study was conducted on 50 women presenting with neurological symptoms during pregnancy or puerperium. Detailed clinical evaluation, laboratory tests, cerebrospinal fluid analysis, neuroimaging (CT/MRI) were performed. Data were statistically analyzed using SPSS, with $p < 0.05$ considered significant. **Result:** The majority of patients were young (98% aged 18–30 years) and socioeconomically disadvantaged (72%). Primary neurological disorders comprised 72% of cases, with tubercular meningitis (35.1%), seizure disorders (21.6%), and cortical venous thrombosis (18.9%) being predominant. Secondary disorders included septic (46.2%) and hepatic encephalopathy (38.5%). Altered sensorium (32.6%) was the most common presentation, followed by headache (21.6%) and motor weakness (19.9%). MRI proved superior to CT, detecting abnormalities in 73.7% versus 28.6% respectively, including edema, venous thrombosis, leptomeningeal enhancement, and tuberculomas. Maternal outcomes showed 72% complete recovery, 16% residual deficits, and 12% mortality. Foetal outcomes included 48% live births, 38% ongoing pregnancies, 14% stillbirths, the latter significantly higher in secondary disorders ($p = 0.006$). **Conclusion:** Neurological disorders in pregnancy are largely driven by infectious and thrombotic causes, disproportionately affecting young women from lower socioeconomic groups. MRI provides superior diagnostic yield over CT and should be prioritized in evaluation. Multidisciplinary management is essential to improve maternal recovery and reduce adverse foetal outcomes. Strengthening antenatal surveillance and early neurological screening may help mitigate risks in high-burden regions.

INTRODUCTION

Neurological disorders during pregnancy and the puerperium present a substantial clinical challenge due to their potential impact on both maternal and foetal health. The physiological changes of pregnancy, including hormonal fluctuations, altered blood volume, and immunological adaptations, can exacerbate pre-existing neurological conditions or trigger new-onset disorders. These conditions range from common issues such as headaches and seizures to more complex problems including stroke, multiple sclerosis, and other neurovascular diseases. The prevalence and severity of these disorders depend on individual health factors, underlying conditions, and the management of pregnancy-related physiological changes. Globally, neurological disorders account for an estimated 15–20% of maternal morbidity and mortality, with epilepsy, stroke, eclampsia, and cerebral venous thrombosis (CVT) representing the majority of cases. Pregnancy-associated changes such as hypercoagulability, increased blood volume, and hormonal shifts can precipitate or worsen these conditions, highlighting the importance of early recognition and multidisciplinary care to improve maternal and foetal outcomes.[1,2]

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In India, neurological complications during pregnancy are increasingly recognized as contributors to adverse maternal and perinatal outcomes. Hospital-based studies report a prevalence ranging from 3.3% to 10.3% among pregnant and postpartum women. Common neurological complications include eclampsia, epilepsy, CVT, and posterior reversible encephalopathy syndrome (PRES), with eclampsia alone accounting for up to 63% of cases in some cohorts. Regional disparities in healthcare infrastructure, awareness, and access to neuroimaging often result in delayed diagnosis and suboptimal management, particularly in resource-limited settings. Younger, primigravida women are particularly vulnerable, reflecting both higher conception rates in this age group and limited prior obstetric experience. Low literacy levels and lower socioeconomic status further compound the risk by delaying healthcare-seeking behavior, impairing symptom recognition, and reducing adherence to medical advice. Postma IR, et. al; 2014, underscored the need for targeted interventions that consider age, parity, and socioeconomic status to mitigate neurological risks during pregnancy.[3,4]

Seizure disorders, particularly epilepsy, are among the most common neurological conditions encountered during pregnancy. Uncontrolled seizures can result in maternal injury, foetal hypoxia, and even foetal death. Management requires careful balancing of maternal and foetal risks, with close monitoring of antiepileptic drug use to minimize teratogenic effects. Similarly, preeclampsia and its complication, eclampsia, pose significant neurological risks. These hypertensive disorders can manifest with headaches, visual disturbances, seizures, and stroke. Their pathophysiology involves complex vascular and inflammatory mechanisms that can compromise cerebral circulation and increase susceptibility to neurological complications. Migraines, common in women of reproductive age, may be exacerbated or alleviated during pregnancy due to hormonal changes. While some women experience relief, others may see worsening frequency and intensity, necessitating careful pharmacological management to avoid foetal harm.[5,6]

Multiple sclerosis (MS), a chronic autoimmune disorder affecting the central nervous system, presents unique challenges. Disease activity often decreases during pregnancy but increases in the postpartum period, likely due to immunological shifts. Management focuses on minimizing relapses while avoiding medications that could harm the developing foetus. Stroke, though less common, is one of the most serious neurological events during pregnancy and the puerperium. Pregnancy-related vascular and hemodynamic changes, such as hypercoagulability and increased blood volume, contribute to the risk of ischemic or hemorrhagic stroke. Delays in diagnosis are common because symptoms may be mistakenly attributed to normal pregnancy changes, emphasizing the need for rapid recognition and intervention to reduce long-term maternal and neonatal consequences.[7]

Other neurological disorders, although less frequent, can significantly impact quality of life during pregnancy. Neuropathies such as carpal tunnel syndrome, resulting from fluid retention and nerve compression, often resolve postpartum but may require symptomatic treatment during pregnancy. Similarly, benign intracranial hypertension, caused by altered cerebrospinal fluid dynamics and pressure, can result in headaches and visual disturbances. Management of neurological disorders in pregnancy requires a multidisciplinary approach involving obstetricians, neurologists, and other specialists. Diagnostic tools, including imaging and laboratory tests, must be carefully selected to balance clinical benefit with foetal safety. Pharmacological treatments need cautious use due to potential teratogenicity, while non-pharmacological measures such as physical therapy, lifestyle modifications, and psychological support are often essential.[8]

Psychosocial factors also play a critical role in outcomes. Stress and anxiety related to managing a neurological condition during pregnancy can adversely affect maternal mental health, contributing to depression or anxiety disorders. Postpartum depression may be exacerbated by neurological complications, making mental health support a vital component of comprehensive care. Integrating physical, neurological, and psychological management, alongside early detection and tailored interventions, is essential to optimize maternal and foetal outcomes, minimize complications, and improve quality of life for affected women.[9]

Neurological disorders during pregnancy and the puerperium require heightened awareness, timely diagnosis, and coordinated care. Conditions such as epilepsy, preeclampsia, stroke, MS, and migraines can be influenced by the physiological and immunological changes of pregnancy, with implications for both maternal and foetal health. Comprehensive multidisciplinary management, careful use of diagnostic and therapeutic interventions, and attention to psychosocial support are critical to mitigating risks and ensuring the best possible outcomes for both mother and child.[10,11]

The study aims to determined the prevalence of total neurological disorders, both primary and secondary, complicating pregnancy and puerperium, and to analyze the maternal and fetal outcomes among patients experiencing neurological disorders during these periods.

MATERIALS AND METHODS

This prospective observational study was conducted at the Department of Medicine, Jawaharlal Nehru Medical College Aligarh Muslim University Aligarh, U.P. (India) from May 2023 to March 2025. Ethical approval has been obtained from the Ethical Approval Committee of Jawaharlal Nehru Medical

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College Aligarh Muslim University Aligarh, U.P. (India).

Study Population: The present study is planned as a pilot study with a convenience sample of 50 patients due to limited data on the prevalence of neurological disorders in pregnancy and puerperium. All eligible female patients aged over 18 years presenting with signs and symptoms suggestive of neurological disease during the research period were enrolled. Patients with eclampsia, those who did not provide consent, or those with contraindications to imaging (CECT-head/MRI-brain) and contrast were excluded.

Data Analysis: All clinical, biochemical, and radiological data were systematically recorded and coded in a secure, password-protected database. Data were managed using Microsoft Excel for preliminary handling and analyzed with IBM SPSS 2019. Descriptive statistics included means, percentages, and standard deviations, while inferential analysis employed the Chi-square test for categorical variables, with p-values <0.05 considered significant. Quality assurance was ensured through standardized, calibrated investigations, double-entry data verification, and periodic audits of procedures and records.

RESULTS

In this study of 50 pregnant and postpartum women, the majority were aged 18–25 years (54 %), followed by 25–30 years (44 %), with only 2 % above 30 years. Most participants were literate (64 %), though 36 % were illiterate, and a large proportion (72 %) came from economically disadvantaged backgrounds, including 46 % classified as poor. Regarding parity, 38 % were primigravida, 32 % G2, 20 % G3, and 10 % G4. Neurologically, 72 % had primary disorders, while 28 % had secondary disorders.

Table 1: Frequency of clinical features in the study cohort

Clinical Feature	Cases	Percentage (%)
Altered sensorium	59	32.60
Headache	39	21.55
Motor weakness	36	19.89
Fever	32	17.68
Seizures	15	8.29

In the study cohort, altered sensorium was the most common clinical feature (32.6%), followed by headache (21.6%), motor weakness (19.9%), fever (17.7%), and seizures (8.3%) among 181 symptom-specific observations.

Table 2: Symptom-wise distribution of co-occurring neurological features

Primary Symptom	Co-occurring Symptom	No. of Cases
Altered Sensorium	Headache	32
	Fever	29
	Motor Weakness	19
	Seizures	13
Seizures	Altered Sensorium	13
	Headache	13
	Fever	5
	Motor Weakness	4
Headache	Altered Sensorium	32
	Fever	24
	Motor Weakness	21
	Seizures	13
Fever	Altered Sensorium	29
	Headache	24
	Motor Weakness	14
	Seizures	5
Motor Weakness	Headache	21
	Altered Sensorium	19
	Fever	14
	Seizures	4

Altered sensorium was the most central symptom, frequently co-occurring with headache (32 cases), fever (29), and motor weakness (19), while headache commonly appeared with altered sensorium and motor weakness, and seizures were least frequent but often accompanied altered sensorium and headache, indicating overlapping neurological involvement.

Among pregnant and postpartum women with paired neurological symptoms, altered sensorium was the most common core feature, often indicating a red-flag sign. When paired with seizures, headache occurred in about one-quarter of cases, suggesting raised intracranial pressure or meningeal irritation. Dyads of altered sensorium with headache or fever showed the highest tertiary symptom burden, with fever or headache in over 40 % of cases, reflecting infectious or inflammatory causes. Motor weakness was less frequent but recurrent alongside altered sensorium, indicating possible cerebrovascular involvement.

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Table 3: Spectrum of primary neurological disorders

Disorder	Frequency	Percentage (%)
Tubercular meningitis	13	35.14
Seizure disorder	8	21.62
Cortical venous thrombosis	7	18.92
Cerebrovascular accident	6	16.22
Acute pyogenic meningitis	2	5.41
Neurocysticercosis	1	2.70
Total	37	100.00

Tubercular meningitis was the most common primary neurological disorder (35.1%), followed by seizure disorder (21.6%), cortical venous thrombosis (18.9%), cerebrovascular accident (16.2%), acute pyogenic meningitis (5.4%), and neurocysticercosis (2.7%) among 37 cases.

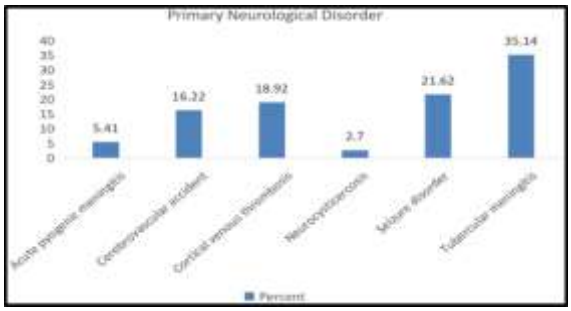

Figure 1: Distribution of primary neurological disorders among pregnant and postpartum women

Among 37 primary neurological cases, tubercular meningitis was most frequent (35.1%), followed by seizure disorder (21.6%), cortical venous thrombosis (18.9%), and cerebrovascular accident (16.2%), while secondary neurological disorders were mainly septic encephalopathy (46.2%) and hepatic encephalopathy (38.5%).

Among 13 participants with secondary neurological disorders, septic encephalopathy was the most common (46.15 %), followed by hepatic encephalopathy (38.46 %) and metabolic encephalopathy (15.38 %). Imaging evaluation revealed that MRI detected abnormalities in 91.67 % of primary and 16.67 % of secondary cases, while CT identified changes in 30.56 % of primary and 22.22 % of secondary disorders, highlighting the superior sensitivity of MRI, particularly for primary neurological conditions in pregnant and postpartum women.

Table 4: CT findings among pregnant and postpartum women

CT Finding	Frequency	Percentage (%)
No diagnostic abnormality	40	71.4
Infarct	7	12.5
Cerebral edema	2	3.6
Mass effect	2	3.6
Hemorrhagic transformation	2	3.6
Cortical venous thrombosis	1	1.8
Subarachnoid haemorrhage	1	1.8
Intraparenchymal bleed	1	1.8
Total	56	100

Among 56 CT scans of pregnant and postpartum women, most were normal (71.4%), while infarcts were seen in 12.5% and cerebral edema, mass effect, hemorrhagic transformation, cortical venous thrombosis, subarachnoid hemorrhage, and intraparenchymal bleed were less frequent.

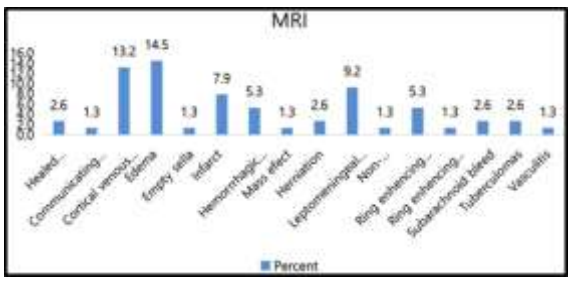

Figure 2: Spectrum of MRI abnormalities detected in the cohort

Among 76 MRI scans of pregnant and postpartum women, 26.3% were normal, while cerebral edema (14.5%), cortical venous thrombosis (13.2%), leptomeningeal enhancement (9.2%), and infarcts (7.9%) were the most common abnormalities, with other lesions being less frequent.

Among 50 pregnant and postpartum women, 36 (72 %) recovered fully, 8 (16 %) had residual neurological deficits, and 6 (12 %) died. In-hospital recovery occurred in 25 (50 %) with primary disorders and 11 (22 %) with secondary disorders, while mortality was 4 (8 %) in primary and 2 (4 %) in secondary cases. Residual deficits were observed only in primary disorder patients. Differences in maternal outcomes between primary and secondary neurological disorders were not statistically significant ($p = 0.565$).

Table 5: Foetal outcomes among pregnant and postpartum women

Outcome	Frequency	Percentage (%)
Live birth	24	48.0
Uneventful pregnancy	19	38.0
Stillbirth (IUD)	7	14.0
Total	50	100.0

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Among 50 pregnancies in the cohort, 48% resulted in live births, 38% had uneventful pregnancies, and 14% ended in stillbirths.

Table 6: Foetal outcomes stratified by type of neurological disorder

Outcome	Primary	Secondary	Total	p-value
Live birth	20 (54.1%)	4 (10.8%)	24	0.006
Uneventful pregnancy	15 (30.0%)	4 (8.0%)	19	
Stillbirth (IUD)	2 (4.0%)	5 (10.0%)	7	
Total	37	13	50	

Among 50 pregnancies, live births occurred in 48% (mostly with primary neurological disorders), 38% were uneventful, and 14% ended in stillbirths, with stillbirths significantly more common in secondary neurological disorders ($p = 0.006$).

DISCUSSION

This hospital-based, cross-sectional study was conducted over two years, from March 2023 to March 2025, at the Medicine and Obstetrics & Gynaecology departments, including OPD, wards, triage, emergency, and trauma centers at JNMCH, Aligarh. The study aimed to evaluate the demographic profile, clinical characteristics, neuroimaging findings, and maternal-foetal outcomes of pregnant and postpartum women presenting with neurological disorders.

The demographic analysis revealed that the majority of participants were young women aged 18–25 years (54%), with 44% in the 25–30 years bracket, reflecting higher conception rates and first-time pregnancies in this age group. Only 2% were older than 30 years, suggesting lower incidence of neurological complications in older mothers. Literacy status indicated that 64% of women were literate, while 36% were uneducated, a factor that may delay symptom recognition and timely healthcare-seeking. Socioeconomic assessment showed that 46% belonged to the lower-income group, with only 12% in upper-middle or high-income brackets, reflecting a pattern consistent with prior reports linking low socioeconomic status to higher maternal morbidity and reduced access to healthcare (Gupta M, et. al; 2020; & Chandrasekaran S, et. al; 2016). Regarding parity, primigravida women constituted 38% and second pregnancies 32%, indicating vulnerability in early pregnancies due to unrecognized underlying conditions or limited obstetric experience, similar to observations by SELVI R, et. al; 2024. These findings highlight the need for age- and socioeconomically tailored interventions to reduce neurological risks in pregnancy.[12-14]

Clinically, primary neurological disorders predominated, accounting for 72% of cases, consistent with prior studies reporting infections, epilepsy, and thrombotic events as common obstetric neurological admissions (Sarella LK & Rao DS, 2014) [15]. Altered sensorium was the most frequent presenting symptom (32.6%), followed by headache (21.55%) and motor weakness (19.89%), suggesting widespread cortical or vascular involvement characteristic of conditions like tubercular meningitis, cortical venous thrombosis, or posterior reversible encephalopathy syndrome. Symptom-overlap analysis showed altered sensorium frequently co-occurring with headache and fever, indicating infectious or inflammatory etiology (Gupta M, et. al; 2020) [12]. Dyads including altered sensorium were often accompanied by additional features such as seizures or motor weakness, reflecting raised intracranial pressure or systemic derangement, corroborating findings by Nagaraj K & SP C. 2019 [16]. Isolated seizures were uncommon, reflecting effective pre-pregnancy seizure control or lower idiopathic epilepsy incidence, as also observed by SELVI R, et. al; 2024. These data emphasize the need for comprehensive neurological assessment in pregnant women presenting with multiple symptoms to enable timely imaging and multidisciplinary management.[14]

The spectrum of neurological disorders showed that primary conditions comprised 72% and secondary conditions 28%. Among primary disorders, tubercular meningitis was most common (35.14%), followed by seizure disorders (21.62%) and cortical venous thrombosis (18.92%), reflecting India's endemic tuberculosis burden and pregnancy-associated immunological changes (Sarella LK & Rao DS, 2014; Thomas, et. al; 2019).[14,17] Secondary neurological disorders were predominantly septic encephalopathy (46.15%) and hepatic encephalopathy (38.46%), emphasizing systemic origins of neurological dysfunction. Neurocysticercosis and metabolic encephalopathy were less frequent (2.7% and 15.38%, respectively), possibly due to improved community health measures and referral bias toward acute cases. Sarella LK & Rao DS, 2014, highlighted the need for early diagnosis, tailored management, and multidisciplinary care to mitigate maternal and foetal risks.[15]

Neuroimaging findings showed that CT scans (n=56) were normal in 71.4% of cases, while abnormal findings included infarcts (12.5%), cerebral edema, mass effect, and hemorrhagic transformation (each 3.6%), with cortical venous thrombosis, subarachnoid hemorrhage, and intraparenchymal bleed in 1.8% each. The predominance of normal CT scans underscores its limited sensitivity in detecting early infective or inflammatory pathology, as reported by Gama S, et. al; 2019 [18]. Infarcts reflected vascular complications in pregnancy,

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consistent with prior studies (Nagaraj K & SP C. 2019). CT served primarily as an emergency triage tool, while MRI offered superior diagnostic sensitivity.[16]

MRI scans (n=76) revealed abnormalities in 73.7% of patients, most commonly cerebral edema (14.5%), cortical venous thrombosis (13.2%), leptomeningeal enhancement (9.2%), and infarcts (7.9%). Ring-enhancing lesions indicative of tuberculomas or neurocysticercosis were seen in 5.3% each. MRI effectively detected parenchymal, vascular, and infectious changes that CT missed, corroborating findings by Gama S, et. al; 2019, and Nagaraj K & SP C. 2019. Vasculitic changes, hydrocephalus, herniation, and mass effect were also identified, demonstrating MRI's essential role in complex or critically ill obstetric patients.[16,18]

Maternal outcomes showed 72% complete recovery, 16% with residual deficits, and 12% mortality. Residual deficits were mainly associated with primary disorders, while mortality occurred in both primary and secondary groups, consistent with prior studies reporting 11–12% mortality among obstetric neurological cases (Nagaraj K & SP C. 2019 and Gupta M, et. al; 2020).[12,16] Foetal outcomes included 48% live births, 38% ongoing uneventful pregnancies, and 14% stillbirths, with stillbirths significantly more common in secondary disorders (p=0.006), in line with prior observations (SELVI R, et. al; 2024 and Gama S, et. al; 2019). These results highlight the critical need for early neuroimaging, vigilant maternal monitoring, and integrated multidisciplinary management to improve maternal and perinatal outcomes.[14,18]

Neurological disorders in pregnancy and the puerperium predominantly affect younger, primigravida women from lower socioeconomic backgrounds. Primary disorders, particularly tubercular meningitis, seizure disorders, and cortical venous thrombosis, constitute the majority, while secondary systemic encephalopathies carry higher foetal risks. MRI is superior to CT in detecting early and subtle neurological changes, guiding timely interventions. Comprehensive antenatal surveillance, prompt neuroimaging, and multidisciplinary management are essential to optimize maternal and foetal outcomes in this vulnerable population.[19,20]

CONCLUSION

This tertiary-care study evaluated neurological disorders in 50 pregnant and postpartum women, focusing on clinical patterns, imaging findings, and maternal-foetal outcomes. Most participants were 18–30 years old (98 %), with 64 % literate and 72 % from socioeconomically disadvantaged backgrounds; 38 % were primigravida. Primary disorders predominated (72 %), led by tubercular meningitis, seizure disorders, cortical venous thrombosis, and strokes, while secondary disorders included septic and hepatic encephalopathy. MRI proved more sensitive than CT in detecting abnormalities. Maternal recovery was favorable in 72 %, with 12 % mortality, while foetal outcomes were worse in secondary disorders (stillbirth 14 %, p = 0.006). The study highlights MRI utility, infectious and thrombotic disorders, and the need for early diagnosis and multidisciplinary care to improve maternal and foetal outcomes.

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