

Magnetic Resonance Imaging in Neurological Disorders in the Postpartum Period

Brajesh Kumar Suman¹, Shivendu², Manoj Kumar Chaudhary³

¹Senior Resident, Department of General Medicine, IGIMS, Patna

²Senior Resident, Department of General Medicine, IGIMS, Patna

³Associate Professor, Department of General Medicine, IGIMS, Patna

Received: 25-03-2024 / Revised: 23-04-2024 / Accepted: 25-05-2024

Corresponding Author: Dr. Manoj Kumar Chaudhary

Conflict of interest: Nil

Abstract:

Background and Objectives: Pregnancy and puerperium is a critical period where many physiological changes take place involving various systems. These changes can result in neurological and hemodynamic disturbances and may sometimes lead to serious adverse effects if prompt treatment is not undertaken. To evaluate the neurological disorders that occur during the puerperal period using magnetic resonance imaging. To identify the imaging features that characterise each of these disorders and correlate with clinical picture.

Material and Methods: Fifty post partum patients with clinical suspicion of neurological disorders referred to the Department of General Medicine, IGIMS, Patna. Study duration of two years. underwent MRI of brain. The main source of data for the study were patients from IGIMS Patna.

Conclusion: MRI was found to be a key modality to evaluate various neurological disorders and to arrive at an accurate diagnosis. Characterization of the lesions and awareness of the common diseases during puerperium will help the clinician arrive at an informed differential diagnosis. MRI is a non-invasive imaging modality with no radiation hazard, excellent resolution and multiplanar imaging capability.

Keywords: Posterior Reversible Encephalopathy Syndrome, Cerebral Venous Thrombosis, Neurological Disorders, Magnetic Resonance Imaging.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Pregnancy and puerperium is a period where many physiological changes involving hemodynamic, coagulation and endocrine system occur. These changes may sometimes lead to adverse effects. A series of neurological disorders may also occur during pregnancy and puerperium that are either unique to or occur with increased frequency during and just after pregnancy. [1] Evaluation of postpartum neurological pathologies is a diagnostic challenge. The common neurological disorders encountered during puerperium include eclamptic encephalopathy, ischemic stroke, cerebral venous thrombosis, intracranial haemorrhage, postpartum cerebral angiopathy and pituitary disorders like pituitary apoplexy, Sheehan syndrome and lymphocytic adenohypophysitis. [2] Usually when puerperal women face any abnormal symptom, these are considered to be a part of pregnancy and ignored. Symptoms and signs are non-specific and it can be difficult to diagnose based on clinical grounds alone. Some diseases such as cerebral venous thrombosis present with non-specific complaints such as headache. However, headache is a common complaint during this period and it is usually treated as a benign headache until serious neurological complications develop. [3] The advent of

Magnetic Resonance Imaging (MRI) has proved to be a boon in early and non-invasive diagnosis of pregnancy related neurological complications. Magnetic resonance imaging helps in recognition of the characteristic imaging findings of various neurological symptoms. [4] Even when imaging changes are less specific, knowledge of likely possibilities will lead to a more informed differential diagnosis to be made. [2] By knowing the prevalence and spectrum of neurological complications affecting our population, early appropriate treatment can be initiated thus improving maternal outcome. [5-9]

Material and Methods

A prospective study of 50 patients presenting to Department of General Medicine, at Indira Gandhi Institute of medical Sciences, Patna. were subjected to MRI examination of brain.

Study Design: Cross sectional descriptive study.

Inclusion Criteria: Patients presenting within 6 weeks of delivery (postpartum period) with recent onset neurological symptoms like: Headache – Rapidly increasing headache intensity or frequency,

headaches associated with seizures, sudden onset of headache thunder-clap type or sudden onset unilateral headache. Seizures – Generalised tonic – clonic type, complex seizures or focal seizures. Sensory or motor deficit – loss of sensation or motor control over various parts of body Altered sensorium – alteration in consciousness assessed by awake, verbal response, response to pain and unresponsiveness (AVPU) scale and Glasgow Coma scale (GCS). Blurring of vision or loss of vision.

Exclusion Criteria: General contraindications to MRI such as pacemakers, aneurysmal clips, cochlear implants and metallic implants or metallic foreign bodies etc. Patients with pre-existing seizure disorder or epilepsy, Claustrophobic patients, Contraindications for use of contrast agents.

The patients selected for the study were puerperal patients with history of neurological complications referred to the Department of medicine for imaging. Patients were interviewed and relevant clinical data was collected. Based on the history and examination, a clinical diagnosis was made. All patients were screened before entry into the MRI scanning room for ferromagnetic objects, cardiac pacemakers, aneurysm clips etc. Patients were examined in the supine position on the MRI machine after proper positioning, and immobilization of the head was obtained.

Results

Age distribution of subjects in the study.

		No.	%
Age	<20 years	5	10.0%
	21 to 25 years	13	26.0%
	26 to 30 years	21	42.0%
	31 to 35 years	7	14.0%
	>35 years	4	8.0%
	Total	50	100.0%

In the study majority of subjects were in the age group 26 to 30 years (42%), 26% were in the age group 21 to 25 years and others.

Postpartum day distribution among subjects

		No.	%
Postpartum day	<48 hrs	8	16.0%
	2 to 7 days	29	58.0%
	1 to 2 weeks	4	8.0%
	>2 weeks	9	18.0%
	Total	50	100.0%

In the study duration, most of the patients presented between 2-7 days post-partum and majority within one-week post-partum.

Parity distribution among subjects

		No.	%
Parity	Primigravida	25	50.0%
	Multipara	25	50.0%
	Total	50	100.0%

In the study 50% were Primigravida and 50% were multipara.

In the study 76% had headache, 58% had vomiting, 44% had seizures, 6% had left hemiparesis, 8% had right hemiparesis, 14% had GCS \leq 10, 6% had Focal neurological deficits, 4% had visual changes and

2% had fever and hallucination respectively. The most common symptom that patients presented with was headache, followed by seizures, hemiparesis and focal neurological deficits.

MR Angiogram findings distribution.

		No.	%
MR Angiogram	Abnormal	1	2.0%
	No abnormality	49	98.0%

MR TOF angiogram was found to be abnormal only in one case of infarct in the left anterior cerebral artery and middle cerebral artery territory, which showed reduced calibre of the left internal

carotid artery and non-visualisation of the anterior cerebral and middle cerebral arteries on the left side. Intraparenchymal hematoma was seen in one case in the gangliocapsular region which was isointense on T1 WI and hypointense on T2 WI

with hyperintense rim on FLAIR image. DWI showed peripheral rim of restricted diffusion. Blooming was seen on SWI. No enhancement was seen on T1 W post contrast images. Tuberculomas was diagnosed in one case which showed multiple T1 hypointense, T2 hypo to isointense lesions with few showing hyperintense centre and FLAIR hyperintense lesions in bilateral frontal, occipital and parietal lobes, basal ganglia and thalami. The lesions showed extensive perilesional oedema on T2W/FLAIR images. The lesions did not show diffusion restriction on DWI or blooming on SWI. On post contrast T1WI, lesions showed peripheral ring enhancement. Mesial temporal sclerosis was seen in one case as decreased volume of bilateral hippocampi (right>left) with loss of interdigitations. T2/FLAIR hyperintense signal was seen in bilateral hippocampi. Temporal horns of bilateral lateral ventricles appeared prominent (right>left). Right mammillary body was atrophied. No diffusion restriction or blooming was seen in the structures mentioned. Meningioma was seen as a well defined extra-axial dural based lesion along left fronto-parietal convexity. Lesion was T1 hypointense, T2/FLAIR hyperintense showing mild diffusion restriction on DWI. No foci of blooming was seen within on SWI. On T1 W post contrast image, significant homogenous enhancement was seen with presence of enhancing dural tail. Neurocysticercosis was diagnosed in one case which showed two well defined T1 hypointense and T2/FLAIR hyperintense lesions in bilateral parietal lobes. One of the lesions in right parietal lobe showed a hypointense focus within on T2WI which was suggestive of scolex. The lesion in left parietal lobe showed focus of diffusion restriction on DWI and significant perilesional edema was seen on T2 W/ FLAIR images. Most of the patients presented in the first one week after delivery. Patients with PRES presented predominantly within the first 48 hours.

Discussion

The patients belonged to reproductive age group ranging from 18 to 40 years. [10,11] The majority of the patients (about 42%) belonged in the age group ranging from 26 to 30 years. 58 % of the patients presented between 2nd to 7th post-partum day. [12,13] A study by TJ Mathews et al and Holsley MD et al showed that increasing age of pregnancy (24.6 to 27.2) in past 30 years has led to increase in complications associated with pregnancy. [14] Out of fifty test subjects in the study, 44% were found to be normal and 56% had findings on MR imaging. Study conducted by Chandrashekeran et al showed 41.6% of patients to have findings

among the study group which was similar to our study [15]. Study conducted by Mugadeeswaran et al showed Eclamptic encephalopathy to be 21% of cases, 15% was cerebral venous thrombosis, 8% was ischemic stroke, 4% was subarachnoid haemorrhage, 3% was pituitary apoplexy and 1% of cases were pituitary apoplexy. An MRI study by Kavthale S et al. involving 40 postpartum patients found that posterior reversible encephalopathy syndrome (PRES) was the most common condition with 60% patients showing its features, followed by cerebral venous thrombosis (CVT) seen in 25% of patients. Present study showed PRES to be most common finding and represented 22% of the cases. Most common clinical diagnosis made was that of intracranial haemorrhage followed by cerebrovascular accident. PRES was associated with infarct in 4% of the cases and haemorrhage in 4% of the cases. Study by Kavthale et al found 24% of patients to have PRES, where 16.6% had infarct and 4.1% had subarachnoid haemorrhage. Cerebral venous thrombosis was seen in 10% of the cases in our study. Among the dural sinuses involved, most commonly thrombosed was the superior sagittal sinus (60%) followed by transverse and sigmoid sinus (20% each). Study by Chandrashekeran et al found cerebral venous thrombosis to be the most common neurological complication of post-partum period at 29.1% of the cases. Sagittal sinus was involved 45.7% of the time followed by transverse sinus (25.7%), sigmoid sinus (17.1%) and straight sinus (11.4%). Kavthale et al found cerebral venous thrombosis in 24% of the patients in the study, out of which superior sagittal sinus was the commonest to be involved (70%) followed by the transverse sinus (60%). The most common clinical symptom associated with CVT in our study was headache, seen in 100% of the cases and associated with vomiting and seizures in 60% of the cases. This was similar to a study conducted by Naveen Thota et al in Journal of Evidence Based Medicine and Health care, where most common symptom was headache (43%) followed by papilloedema. Our study showed cerebral venous thrombosis to be associated with T2/FLAIR hyperintense lesion which indicated venous infarct. None of the cases showed diffusion restriction indicating that they were secondary to vasogenic oedema. Blooming was seen in one of the cases indicating haemorrhagic transformation. Study done by Naveen Thota et al showed haemorrhagic infarct in 50% of the cases. Restricted diffusion was seen in 18% of the cases. No parenchymal lesion was found in 18% of the patients. [16]

Table 1: Parenchymal abnormality in CVT in present study vs literature

Imaging findings	Present study (n=5)	Naveen Thota et al (n=50)
Lobar haemorrhage	10%	50%
Restricted diffusion	0%	18%

Our study showed infarcts in 12% of the cases. Out of these 28.6% showed haemorrhagic transformation. A study done by Skidmore et al found 58.3% had ischemic stroke, 30.5% had haemorrhagic stroke and 11.1% patients had venous infarcts. [17]

Table 2: Comparison between incidence of ischemic vs haemorrhagic stroke in present study and literature

Imaging findings	Present study (n=6)	Skidmore et al (n=40)
Ischemic stroke	71.4%	58.3%
Haemorrhagic stroke	28.6%	30.5%

Conclusion

MRI is an excellent modality for detection of pathology and characterisation of the neurological disorders in the post-partum period. Posterior reversible encephalopathy syndrome was the most common disorder seen, followed by infarcts and cerebral venous thrombosis. MRI was helpful in describing the features and to diagnose various conditions.

References

- Philips E, Samuels P. Neurological disorders in pregnancy. In: Gabbe SG, Niebyl JR, editors. *Gabbe's Textbook of Obstetrics Normal and Problem pregnancies*, 7th Ed. Elsevier ; 2017 : 1030-57
- Zak TI, Dulai HS, Kish KK. Imaging of Neurologic Disorders Associated with Pregnancy and the Postpartum Period. *Radio Graphics*. 2007; 27:95-108.
- Kavthale SS, Kadam MM, Babar M, Shewale V. Study of the imaging features of various neurological pathologies in post-partum period using MRI. *MedPulse – International Medical Journal*. 2016 April; 3(4):418-422.
- Hacein-Bey L, Varelas PN, Ulmer JL, Mark LP, Raghavan K, Provenzale JM. Imaging of cerebrovascular disease in pregnancy and the puerperium. *American Journal of Roentgenology*. 2016 Jan; 206(1):26-38.
- DC Duttas. *Textbook of Obstetrics*, Seventh Edition, Kolkata, New Central Book Agency (P) Limited, 2011. Chapter 13: Normal Puerperium; 144-153
- Hosley CM, McCullough LD. Acute neurological issues in pregnancy and the peripartum. *Neurohospitalist* 2011;1 (2):104–116.
- Edlow JA, Caplan LR, O'Brien K, Tibbles CD. Diagnosis of acute neurological emergencies in pregnant and post-partum women. *Lancet Neurol* 2013;12(2):175–185.
- Quantitative estimation of human uterine artery blood flow and pelvic blood flow redistribution in pregnancy. Palmer SK, Zamudio S, Coffin C, Parker S, Stamm E, Moore LG *Obstet Gynecol*. 1992 Dec; 80(6):1000-6.
- Incidentally detected thrombocytopenia in healthy mothers and their infants. *Burrows RF, Kelton JG N Engl J Med*. 1988 Jul 21; 319(3): 142-5.
- Stella CL, Jodicke CD, How HY, Harkness UF, Sibai BM. Postpartum headache: is your work-up complete *Am J Obstet Gynecol* 2007; 196: 318.
- Hui FK, Obuchowski NA, John S, Toth G, Katzan I, Wisco D, Cheng-Ching E, Uchino K, Man SM, Hussain S. ASPECTS discrepancies between CT and MR imaging: analysis and implications for triage protocols in acute ischemic stroke. *Journal of neurointerventional surgery*. 2017 Mar 1;9(3):240-3.
- Lin L, Bivard A, Krishnamurthy V, Levi CR, Parsons MW. Whole-brain CT perfusion to quantify acute ischemic penumbra and core. *Radiology*. 2016 Jan 18;279(3):876-87.
- Al-Hayali RM, Al-Habbo DJ, Hammo MK. Peripartum neurological emergencies in a Critical Care Unit. *Neurosciences*. 2008 Apr 1; 13 (2):155-60.
- Mathews TJ, Hamilton BE. Mean age of mother, 1970–2000. *National vital statistics reports*. 2002 Dec 11;51(1):1-4.
- Shah AK. Non-aneurysmal primary subarachnoid hemorrhage in pregnancy-induced hypertension and eclampsia. *Neurology* 2003;61(1): 117–120.
- Naveen T, Krishna GR, Vengamma B, Dayakar D, Dushyanth J. Clinical manifestations, radiological findings and outcome in cerebral vein and dural sinus thrombosis: a prospective study. *Journal of Evidence based Medicine and Healthcare*. 2015 Sep 28;2(39):6171-81.
- Skidmore FM, Williams LS, Fradkin KD, Alonso RJ, Biller J. Presentation, etiology, and outcome of stroke in pregnancy and puerperium. *Journal of Stroke and Cerebrovascular Diseases*. 2001 Jan 1;10(1):1-0.