

# DIAGNOSIS OF ACUTE NEUROLOGIC EMERGENCIES IN PREGNANT AND POSTPARTUM WOMEN USING MRI AS ROBUST DIAGNOSTIC TOOL, EXPERIENCE FROM A PUBLIC SECTOR TERTIARY CARE HOSPITAL

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## ABSTRACT

**BACKGROUND:** Acute neurological diseases requiring hospitalization are rare in young women. Many are unique to pregnancy and the postpartum period, contribute to approximately 20% of maternal deaths which is significant. MRI is safe in pregnancy and is the investigation of choice for most of these diseases. **OBJECTIVE:** To study the role of MRI in diagnosis of acute neurologic emergencies in pregnant and postpartum women. **METHODS:** This was a retrospective study carried in the Department of Radiology, JPMC hospital over one 1 year from November 2015 to November 2016, after approval by ethical review committee of the hospital. Patients referred to our department for MRI brain with complaints of neurological symptoms and signs during pregnancy, in peripartum period (up to 6 weeks) were included in the study. **RESULT:** Total of 31 patients with signs and symptoms of acute neurological diseases were evaluated using MRI brain. Age range was between 18 to 40 years with mean average of 25.9 year. The commonest radiological diagnosis was PRES in 13 patients. Other patients had CVST 9 patients (with hemorrhagic infarct), acute infarction in 5 patients and pituitary apoplexy 1 patient. 1 patient had tuberculoma. 2 patients had unremarkable brain imaging. **CONCLUSION:** Radiologists must be well aware of the imaging findings of acute neurological emergencies and their complications, occurring in pregnancy and the puerperium. With early and accurate diagnosis, radiologists may make important contributions to the care of this patient population.

**Keywords:** PRES, MRI in peripartum, CVST in pregnant women, stroke in puerperium

## Descriptor

Acute neurological diseases necessitating inpatient neurologic consultations are uncommon in young women, several are particular to pregnancy and the postpartum period.<sup>1</sup> These distinct diseases can affect the central nervous system as well as pituitary gland. Some are exclusive to the physiologic changes of pregnancy e.g. eclampsia, postpartum cerebral angiopathy, reversible cerebral vasoconstriction syndrome, posterior reversible encephalopathy syndrome, Sheehan syndrome, lymphocytic adenohypo-

physitis. Others are nonspecific but occur more common in pregnant women including cerebral infarction, cerebral dural venous thrombosis and pituitary apoplexy.<sup>2</sup> The symptoms of this diverse group of acute neurological diseases are either nonspecific or overlapping, it can be challenging to make out the diagnosis clinically.<sup>3</sup> Delayed diagnosis not only leads to devastating complications but also contributes to approximately 20% of maternal mortality.<sup>1,4</sup> Imaging has paramount role in the differentiation and exclusion of various neurologic conditions, and most of the time, imaging findings can point the clinician to

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accurate diagnosis.<sup>3</sup> The frequent and most invoked imaging tool is unenhanced CT brain, but it has low diagnostic ability for subtle white matter changes and inability to survey the intracranial vasculature<sup>5,6</sup> often giving non diagnostic or falsely negative results and leads to delayed diagnosis.<sup>5</sup>

The safe and excellent imaging modality having high diagnostic yield for most of acute neurologic diseases peculiar to pregnant and peripartum women is MRI.<sup>1,6</sup> MRI aids in identification of the discriminating imaging findings in these diseases and allow exclusion of others. In cases when imaging findings are unequivocal, awareness of acute neurological diseases associated with peripartum and consciousness of the increased probability of certain diseases in this period will allow a brief differential diagnosis.<sup>2</sup>

The aim of this article is to study the common acute neurological diseases in pregnancy and postpartum period.

## Methods

This was a retrospective study carried in the Department of Diagnostic Radiology, Jinnah post medical center hospital over one 1 year from November 2015 to November 2016, after approval by ethical review committee of the hospital. Patients referred to our department for MRI after neurologic consultations requested from obstetric team were included. The patients had complaints of acute neurological symptoms and signs including preexisting worsening or new onset severe headache, ALOC, fits, visual blurring, acute onset visual loss, fever and neurological deficit during pregnancy, in postpartum or post abortion period (up to 6 weeks) were included in the study. Patient's demographics and clinical history were evaluated by retrieving medical records and interviewing patients on phone calls. Demographic variables, pregnancy features including parity, gestational age, trimester, ante partum complication, history of medical, neurologic, and obstetrical illnesses and mode of delivery were ascertained.

All imaging were done on Phillips 1.5 Tesla MR Scanner, using 8-channel high resolution head coil. Base line images including axial T1, T2, Sagittal T2 and coronal FLAIR sequences with slice thickness of 5 mm, were retrieved. DWI/ADC mapping and sus-

ceptibility sequences were done. Additional sequences including post contrast axial, coronal and sagittal images and MRV or MRA (time of flight) were also acquired in selected patients.

Team of experienced radiologist and resident having adequate experience in neuroradiology reviewed all the cases.

## Results

Total of 31 patients with signs and symptoms of acute neurological diseases were evaluated using MRI brain, additional MRV (time of flight sequence) was performed in 9 selected patients. Age range was between 18 to 40 years with mean average of 25.9 year. The commonest radiological diagnosis was PRES in 13 patients. Other patients had CVST 9 patients (with hemorrhagic infarct), acute infarction in 5 patients (acute ischemic infarct 3 patients & acute venous infarct without evidence of CVST 2 patients) and pituitary apoplexy 1 patient. 1 patient had tuberculoma. 2 patients had unremarkable brain imaging. (Tab. 1)

S/No.	Imaging Diagnosis	No. of patients
1	PRES	13
2	CVST	9
3	Acute ischemic infarction	3
4	Acute venous infarction	2
5	Pituitary apoplexy	1
6	Tuberculoma	1
7	Unremarkable imaging	2
	Total patients	31

Table 1: Imaging diagnosis

Mode of delivery (Tab. 2) was emergency Cesarean section in 15 patients, spontaneous vaginal delivery in 12 patients and 4 women had abortion during second trimester.

S/No.	Mode of delivery	No. of patients
1	Cesarean section	15
2	Spontaneous vaginal delivery (SVD)	12
3	Abortion	4

Table 2: Mode of delivery

Most of patients presented with combination of symptoms (Tab. 3) with most common symptom being

altered level of consciousness followed by severe headache, acute limb weakness and fits. History of gestational hypertension was present in 24 patients. High grade puerperal fever was also the presenting complaints in 7 patients.

S/No.	Symptoms	No. of patients
1	Gestational HTN	24
2	Altered level of consciousness (ALOC)	14
3	Headache	13
4	Limb weakness / neurological deficit	10
5	Fits	10
6	Fever	7
7	Visual blurring	2
8	Acute loss of vision	2

Table 3: Presenting maternal morbidities

## Discussion

PRES was most prevalent disease in our series. Patients presented with rapidly developing symptoms of Headache, ALOC, fits and visual blurring. Headache was the most frequent one. All the patients had gestational hypertension. Follow up imaging was also done that showed complete resolution in 5 patients, interval regression in 4 and non-resolution in 1 patient (after 8 weeks). 3 patients were lost to follow up. PRES was also most frequent diagnosis in series of Shanthirani B et al,<sup>7</sup> and Gull P et al.<sup>8</sup>

PRES is potentially reversible condition but can progress to non-reversible infarction if not managed early.<sup>5</sup>

The pathophysiologic mechanism in PRES is thought to be vasogenic edema caused by impaired cerebral auto regulation and endothelial dysfunction.<sup>6,9</sup>

The arche type neuroimaging findings of PRES are essentially due to vasogenic edema and include symmetrical T2W and FLAIR hyper intensities in subcortical white matter in occipital lobes without corresponding diffusion restriction on DWI/ADC mapping.<sup>10,11</sup> (Fig. 1)

However, edema may also be seen in other cerebral regions.<sup>6</sup> We noticed most frequent involvement of occipital lobe followed by parietal lobe, frontal lobe, basal ganglia, cerebellar hemisphere and brain stem. We also noticed exclusive frontal lobe involvement in one patient. (Graph 1) Diffusion weighted imaging

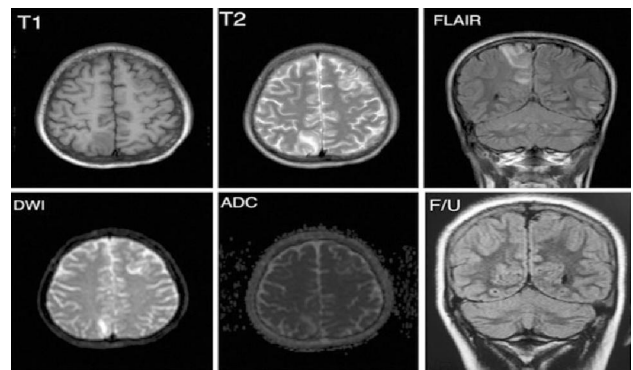
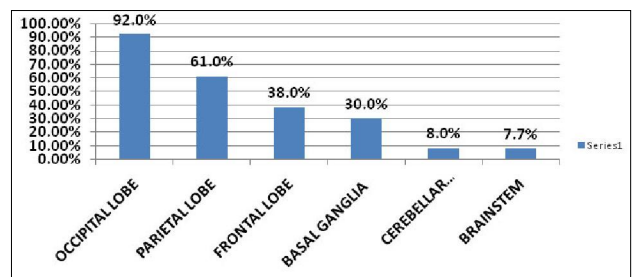


Figure 1: PRES; Multiplaner and multisequential images show T2W and FLAIR hyper intensity in right parietal lobe, not showing corresponding diffusion restriction and resolution on follow up imaging



Graph 1: Showing involvement of brain regions in PRES

is particularly helpful in differentiating vasogenic of PRES from cytotoxic edema and helps radiologist in confidently excluding infarction.<sup>12</sup>

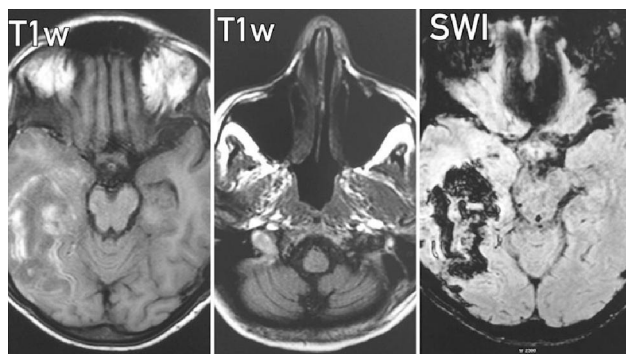
The CVST with hemorrhagic venous infarction was the second most common disorder, comprising of 9 patients. Symptoms were ALOC, neurological deficit and fever. The most common symptom was ALOC/neurological deficit. MRV sequence (time of flight) was done in all 9 patients.

Pregnancy and puerperium are most prevalent pro thrombotic states leading to cerebral venous thrombosis.<sup>13</sup> Contributing factors to hypercoagulability include adaptive physiological changes in the body to fulfill demands of growing fetus and hemodynamic changes to reduce puerperal hemorrhage, during puerperium infection and instrumental delivery or Caesarean section are additional risk factors and in postpartum period risk may be aggravated by volume depletion.<sup>13,14,15</sup>

MRI with the inclusion of MR venography and susceptibility-weighted imaging is the imaging study of choice for diagnosing dural sinus thrombosis.<sup>16</sup> On MRI Thrombus in dural sinus appears as high signal on T1, T2-weighted images and FLAIR se-

quence. However, in the early stage of evolution thrombus may appear isointense to brain on T1-weighted images and hypointense on T2-weighted images, mimicking normal flow.<sup>17</sup>

This pitfall can be overcome by use of gadolinium enhanced MRI that shows corresponding filling defect in dural sinus on post contrast images.<sup>3</sup> In our study all cases of CVST are seen with associated venous infarct. Venous etiology is suspected when infarctions occur in non-arterial territory, watershed or bilateral thalamic regions, usually having hemorrhagic transformation as well, typically at grey-white matter junction. Hemorrhage appears as hyper intense foci on T1 and T2 (T2-hemosiderin rim) with corresponding signal drop out on susceptibility weighted sequence. Diffusion-weighted and susceptibility-weighted sequences are particularly helpful in diagnosing acute arterial ischemia and hemorrhagic infarction respectively. MRV also adds to the diagnostic value of routine MR imaging and better demonstrates the layout of the major cerebral veins and dural venous sinuses.<sup>2</sup> (Fig. 2)



**Figure 2:** CVST; Multiplaner and multisequential images show hyper intensities on T1WI with corresponding signal dropout on SWI represent hemorrhage. Loss of normal flow void in right sigmoid sinus, due to sinus thrombosis.

Next leading cause of acute neurological emergencies was stroke with complaints of neurological deficit, visual blindness and seizures. 3 out of 5 cases were acute ischemic infarcts showing diffusion restriction in arterial territory and 2 cases were watershed venous infarcts, however no radiological evidence of CVST was found on MRI and MRV. Gestational hypertension was a constant feature in these patients. All have presented with acute onset of the symptoms within first three postpartum days.

Risk of ischemic stroke and intracranial hemorrhage due to prothrombotic state is high in the peripartum

and puerperium state rather than pregnancy.<sup>2,18,19</sup> While pregnancy related ischemic and hemorrhagic strokes are associated with Pre eclampsia and Hypertension.<sup>20,21</sup>

In two patients, presented with complaint of headache had normal neuroimaging.

Another patient, primi gravida with history of prolonged labor presented with symptoms of visual blurring and headache on her 2<sup>nd</sup> post partum day, was diagnosed as case of pituitary apoplexy. MR imaging showed enlarged pituitary gland with hyper intensities on T1 with fluid level on T2 in it.

Another patient presented on her first post abortion with complaints of fever, headache and fits. The differential diagnosis was CVST and PRES. On imaging, ring enhancing supratentorial lesions were seen with partial diffusion restriction in them and diagnosed as tuberculoma. In this case MR imaging ruled out the common clinical differentials lead to diagnosis of tuberculoma.

Shanthirani B et al,<sup>7</sup> and Gull P et al<sup>8</sup> and Al-Hayali et al<sup>22</sup> in their studies also found most common disease to be PRES followed by CVST and stroke.

## Conclusion

Acute neurological diseases seen in pregnant and peripartum women are diverse group of disorders. MRI is the modality of choice having high diagnostic accuracy for most of them. Early radiological referral and use of accurate imaging tools will create substantial positive impact on women health care.

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