

# Acute Neurological Disorders in Women during Pregnancy and Puerperium- A Cross Sectional Study

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## Research Article

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## Abstract

**Objective:** To describe various imaging feature of acute neurological complications during pregnancy and puerperium, thereby sensitising the treating physician to necessitate appropriate treatment.

**Method:** A cross sectional prospective study (MRI Brain) was done on 105 women suspected of acute neurological disorders during pregnancy and puerperium during the period January 2017- January 2018 in the department of Radiodiagnosis, in SSIMS & RC, Davangere and the results were analyzed.

**Results :** Posterior Reversible Encephalopathy Syndrome was the most common neurological disorders in our study, accounting for 36% of acute neurological disorder followed by cerebrovascular thrombosis (CVT) (accounting for 22.8%), cerebrovascular accident (CVA) (8.2%), SAH (6.6%), meningitis (4.7%), Wernicke's encephalopathy (1.9%) and pituitary disorders (1.9%). 19 patients (17.7%) of the total had normal features on imaging.

We also characterised 3 imaging patterns of posterior reversible encephalopathy syndrome, which was the most common neurological disorder.

Typical feature consisting of bilateral symmetrical T2 and FLAIR hyperintensities with no diffusion restriction on MRI.

Bilateral symmetrical T2 and FLAIR hyperintensity with subtle diffusion restriction on MRI.

Bilateral symmetrical T2 and FLAIR hyperintensity with foci of hemorrhage.

**Conclusion:** The incidence of acute neurological complication in pregnancy and puerperium is fairly high. PRES (36.1%) and CVT (22.8%) were the most common entities noticed. The most common presenting symptom is headache followed by seizures. Women in their puerperal period (from day 5-day 10) were more vulnerable for acute neurological complications according to our study. Hence timely imaging and familiarising spectrum of radiological features in women during pregnancy and puerperium is needed for initiating early therapy and preventing complications for both the mother and the fetus.

**Keywords:** Neurological Disorder; Cerebral Venous Thrombosis; Posterior Reversible Encephalopathy Syndrome

**Abbreviations:** CVT: Cerebrovascular Thrombosis; CNS: Central Nervous System; MRI: Magnetic Resonance Imaging; FLAIR: Fluid Attenuated Inversion Recovery; DWI: Diffusion Weighted Imaging; SWAN: Susceptibility Weighted Angiography; MRV: Magnetic Resonance Venography; GRE: Gradient Recalled Echo; TOF: Time of Flight.

## Introduction

A variety of acute neurological disorders may be encountered during pregnancy and puerperium. Some are specific to the physiological process of reproduction (eclampsia, post-partum cerebral angiopathy, Sheehan's and lymphocytic adenohypophysitis) and others are non specific but occur more often in pregnant women (infarction, CVT, pituitary apoplexy).

Pregnant women experience symptomatic improvement of migraine headache during pregnancy. However headache remains the most common symptoms experienced during pregnancy and puerperium. Thus the development of acute headache should be viewed seriously.

There is a considerable overlap between clinical features of various neurological disorders affecting CNS during pregnancy. There is a general tendency for delayed diagnosis of uncommon but serious condition during pregnancy because of reluctance of performing appropriate timely imaging.

This article surveys the spectrum of neurological disorders with their typical and atypical imaging features during the course of pregnancy and puerperium, thereby familiarising the imagiologist and treating physicians to necessitate timely imaging and treatment for optimized better maternal and fetal outcome.

## Materials and Methods

A hospital based cross-sectional study of MRI Brain was conducted in the Department of Radiodiagnosis, SSIMS & RC, Davangere for a period of 1 year from January 2017-January 2018 on 105 women during their pregnancy and puerperium presenting with neurological complaints.

## Inclusion Criteria

MRI of Brain was performed in 105 women, suspected of acute neurological disorders during pregnancy and puerperium.

## Exclusion Criteria

The patients who were unwilling for study and those with contra-indications for MRI imaging were excluded from the study.

## MR Imaging Protocol

MR imaging was performed on a 1.5 Tesla 16 channel MR system with dedicated head coil. MRI of brain was performed with standard brain protocol which included: Axial T2, Coronal and axial FLAIR, DWI, Sag T1, GRE/SWAN, Inhance MR Venography, TOF MR angiography for Circle of Willis sequences were performed. Post gadolinium contrast imaging was done in unequivocal cases.

## Results

Women in the age group of 24-26 years constituted the most common group among the total 105 patients.ie 24.7% (Table 1).

Age group	No of patients	Percentage
<20	8	7.6%
20-22	16	15.2%
22-24	22	20.9%
24-26	26	24.7%
26-28	16	15.3%
28-30	7	6.7%
>30	10	9.6%
<b>Total</b>	<b>105</b>	<b>100%</b>

Table 1: Table showing Age distribution of patients.

Out of 105 patients 82 patients (79%) presented in puerperal period. In puerperal period 46 out of 82 patients presented at day5-day 10 of puerperium (accounting to 56% of patients during the puerperium) (Table 2).

Trimesters	Days of presentation	Percentage (out of 105 patients)
I trimester	7	6.6%
II trimester	2	1.9%
III trimester	14	13.3%
1-5days postpartum	26	24.7%
5-10days postpartum	46	43.9%
>10days postpartum	10	9.6%
<b>Total</b>	<b>105</b>	<b>100%</b>

Table 2: Table showing day of presentation.

Most common clinical symptom in our study population was headache, accounting for 50.4% of our study population followed by seizure 29(27.6%), neurological deficit (9.5%), decreased responsiveness (6.6%) and altered sensorium (5.8%) (Table 3).

Clinical Symptom	No of patients	Percentage (out of 105 patients)
Headache	53	50.4%
Seizure	29	27.6%
Neurological deficit	10	9.5%
Decreased responsiveness	7	6.6%
Altered sensorium	6	5.8%
<b>Total</b>	<b>105</b>	<b>100%</b>

Table 3: Distribution of clinical symptoms.

PRES was the most common neurological disorder in our study (accounting for 36%) of acute neurological disorder followed by CVT (accounting for 22.8% of acute neurological disorder), CVA (8.2%), SAH (6.6%), meningitis (4.7%), Wernicke's encephalopathy and pituitary disorders (accounting for 1.9%) (Table 4).

Acute Neurological disorder	No of patients	Percent age
Posterior reversible encephalopathy syndrome(PRES)	38	36%
Cerebral venous thrombosis(CVT)	24	22.8%
Cerebro-vascular accident(CVA)	8	8.2%
Others		
SAH	7	6.6%
Meningitis	5	4.7%
Wernicke's Encephalopathy	2	1.9%
Pituitary disorders	2	1.9%
Normal	19	18%
<b>Total</b>	<b>105</b>	<b>100%</b>

Table 4: Spectrum of acute neurological disorders on imaging.

We also characterised 3 imaging patterns of posterior reversible encephalopathy syndrome, which was the most common neurological disorder, accounting for 36.1% of cases.

- Typical feature-bilateral symmetrical T2 and FLAIR hyperintensities with no diffusion restriction on MRI.
- Bilateral symmetrical T2 and FLAIR hyperintensity with subtle diffusion restriction on MRI.
- Bilateral symmetrical T2 and FLAIR hyperintensity with foci of hemorrhage.

Typical imaging features were seen in 27 out of 38 patients (accounting for 71%) and 11 out of 38 patients showed atypical imaging features (accounting for 29%).

When PRES was analysed based on the region involved, more than one region was involved in majority of the cases. Occipital region was the most commonly involved, (30 out of 38 patients) followed by parietal lobe (24 out of 38 patients). Only 1 patient had brainstem involvement (Table 5).

Frontal	8
Parietal	24
Temporal	4
Occipital	30
Cerebellar	4
Brainstem	1

Table 5: Based on region involved in Posterior Reversible encephalopathy syndrome.

Among 24 patients with CVT, 11 of them (44%) presented with only venous thrombosis with no significant brain parenchymal changes. Eight of them (32%) presented with hemorrhagic infarct and rest 5 of them (24%) presented with non-hemorrhagic infarct.

8 patients in our study presented with cerebrovascular accident (CVA). 5 of them were with ischemic infarct, accounting for 62.5% of CVA and rest 3 were with hypertensive stroke, accounting for 37.5% of CVA. The atypical venous haemorrhagic infarct secondary to CVT were not included in CVA and only the typical hypertensive hemorrhage was included.

## Discussion

A wide range of neurologic conditions can affect women during pregnancy and puerperium [1,2]. The acute neurological disorders encountered in our study were grouped under cerebrovascular disorders and others (pituitary and metabolic disorders).

The patients in our study were between the age group of 18-39. Maximum of them presented between 24-26 age (24.5%). In a study by Sarella, et al. [3] the range of age in their study was 17-31 years.

In our study majority of the patients presented during puerperium with 56% of them presenting at 5-10 days postpartum. Most disorders in a study by Gupta S, et al. [4] were encountered in the peripartum period and they attributed it to noncompliance, physical exhaustion or metabolic derangements during the puerperal period. In a study by Sarella, et al. [3] majority of patients presented during pregnancy with a small percentage presenting at puerperal period.

Headache was the main clinical symptom encountered in our study followed by seizure, neurological deficits, decreased responsiveness and altered sensorium. In the study by Sarella, et al. [3] 49% of their patients presented with seizure.

The most common acute neurological disorder encountered in our study was Posterior reversible encephalopathy syndrome (36.1%) followed by cerebral

venous thrombosis (22.8%), cerebrovascular accidents (8.2%), SAH (6.6%), Meningitis (4.7%), Wernicke's encephalopathy (1.9%) and Pituitary disorder (1.9%). The findings were similar to the study conducted by Magudeeswaran, et al. [5] Table 6. In a study conducted by Hiremath, et al. [6], CVT was the most common neurological entity encountered Table 6.

	Magudeeswaran, et al. (2017) (5) (n=150) (%)	Hiremath, et al. (2014) (6) (n=40) (%)	Present study (n=105) (%)
PRES/Eclamptic encephalopathy	21(33.3)	11(27.5)	38(36)
CVT	15(23.8)	17(42.5)	24(22.8)
CVA	8(12.7)	1(2.5)	8(8.2%)
SAH	4(6.3)	-	7(6.6%)
Pituitary disorders	1(1.5)	-	2(1.9%)
Meningitis	-	1(2.5)	5(4.7)
Normal	-	9(22.5)	19(17.1%)

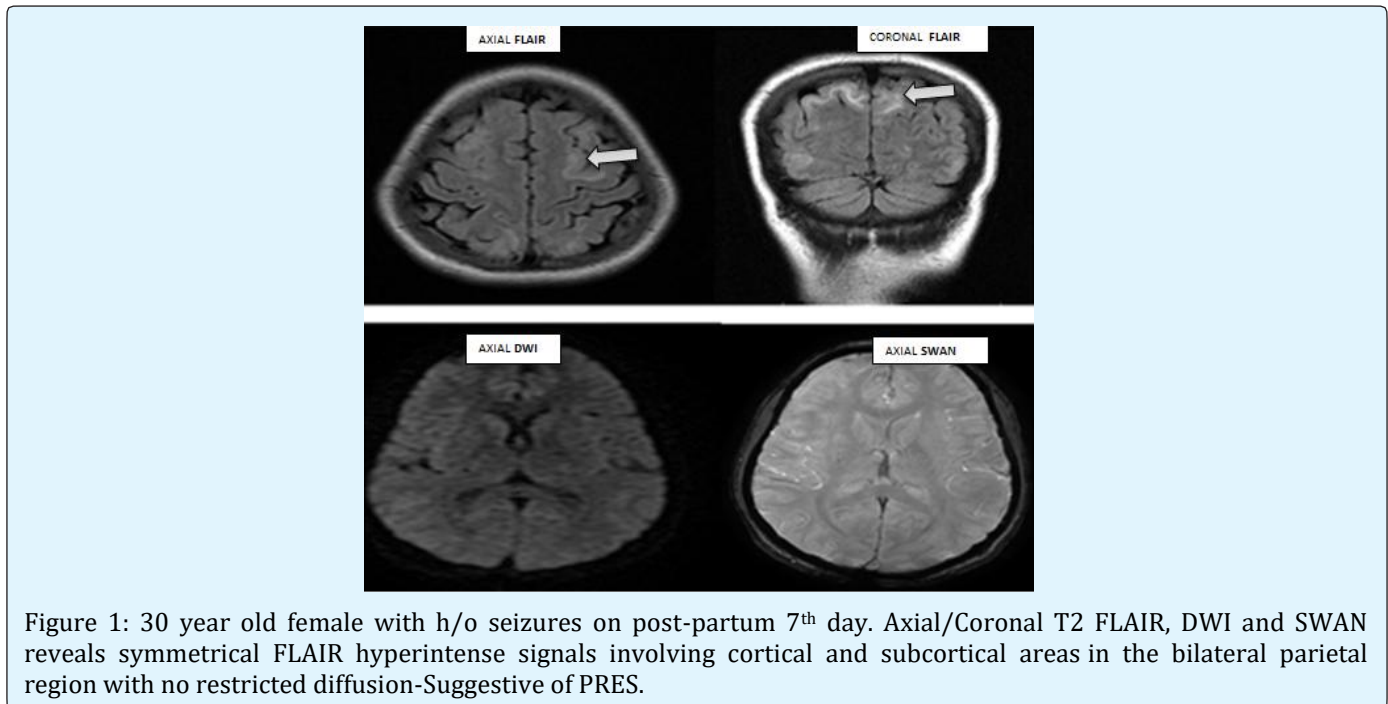
Table 6: Comparison of the spectrum of acute neurological disorders in pregnancy and puerperium.

The incidence of eclampsia in the developing world is reported to be 1 in 100 to 1 in 1700 pregnancies [7]. The mechanism of posterior reversible encephalopathy syndrome in eclampsia is still debatable with predilection for posterior circulation explained by sparse vasomotor sympathetic innervations [8].

The current study showed that PRES is the most

common acute neurological disorder in women during pregnancy and puerperium accounting for 36%. These patients who underwent MR Brain with features of PRES showed 3 patterns of imaging characteristics.

a) Typical imaging features of PRES, i.e., Bilateral symmetrical T2/FLAIR hyperintensity with no diffusion restriction (Figure 1).



b) PRES with subtle diffusion restriction (Figure 2).

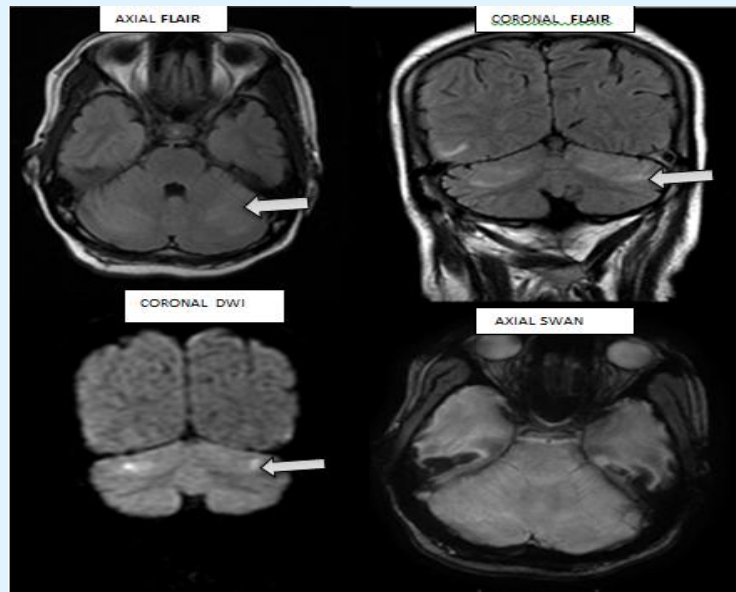


Figure 2: 20 year old postpartum female with antepartum pre-eclampsia now co seizure. Axial and Coronal T2 FLAIR, DWI and SWAN reveal high signal intensity involving bilateral cerebellar hemisphere with diffusion restriction-Indicative of PRES.

c) PRES with few foci of hemorrhage (Figure 3).

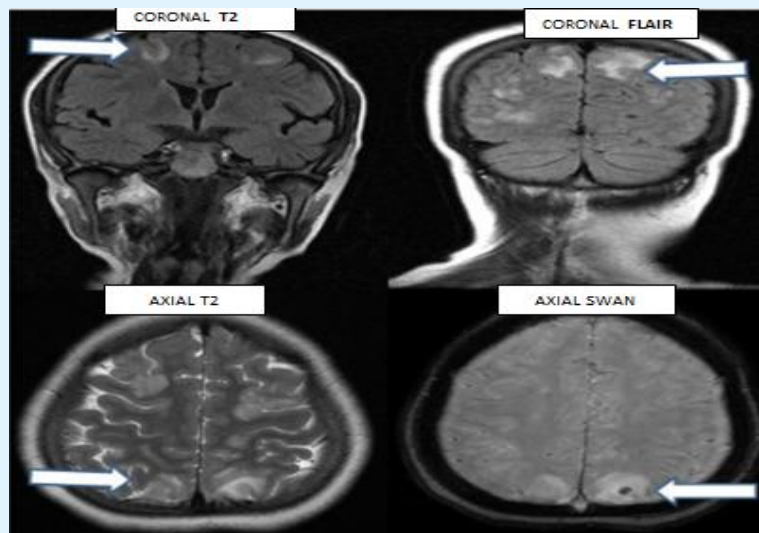


Figure 3: 24 year old postpartum women with h/o pre eclampsia, presented with one episode of seizure MRI brain reveals bilateral symmetrical T2/FLAIR hyperintensities involving bilateral frontoparietal region with a foci of hemorrhage in left parietal lobe-Diagnosis of Posterior Reversible Encephalopathy was made.

Typical features were seen in 71% of cases. In eclamptic encephalopathy most commonly involved brain regions are parieto-occipital, frontal, temporal and sometimes even cerebellar hemispheres [9] with atypical

cases even basal ganglia, and thalamus & brainstem were involved [10]. In our study predominantly parieto-occipital lobe involvement was seen. The regions involved were similar to the study by Hiremath, et al. [6].

In study conducted by Richard B, et al. [11], in 20 patients with eclamptic encephalopathy, most commonly involved region was occipital lobe followed by parietal lobe. Two patients in his study showed changes in the cerebellum [11]. In another study conducted by Bartyński, et al. [12], parieto-occipital lobe was involved most

commonly (98%) followed by frontal lobe (68%) and cerebellar hemispheres (32%). The regions involved in our present study was comparable to the study conducted by Hiremath, et al. [6] where following parieto-occipital lobe involvement, frontal and cerebellar regions were noticed (Table 7).

	Hiremath et al(2014)(n=11)(6)	Present study (n=36)
Occipital	11	30
Parietal	11	24
Frontal	5	8
Cerebellum	1	4
Basal ganglia	1	1

Table 7: Comparison of the regions in brain involved in Posterior reversible encephalopathy syndrome by Hiremath, et al. [6] and our present study.

Cerebral venous thrombosis refers to thrombosis on intracranial venous channels including dural venous thrombosis, cortical venous thrombosis and deep vein thrombosis. CVT may occur anytime during the course of pregnancy and the puerperium, but the risk is highest during the first 2 weeks of the puerperium [13]. CVT accounts for 6% of maternal deaths and highest being for young mothers and after caesarean section [14]. The clinical presentation varies depending on the severity and extent of thrombosis as well as the mode of onset. It may vary from headache to coma. In sepsis cavernous and lateral sinus thrombosis are mostly involved whereas superior sagittal sinus is most commonly involved in non-septic CVT [8].

MRI is more sensitive in picking up lesions and their extent than CT. Diagnostic merit of MRI can be enhanced by performing MR venography (MRV) with contrast or without contrast using TOF time of flight sequences. In our study majority (44% of patients with CVT) of patients presented with only venous thrombosis without brain parenchymal changes (Figure 4). In study by Hiremath, et al. [6] out of 17 patients with cerebral venous thrombosis only three patients showed no parenchymal changes. 32% of the patients with CVT in our study had haemorrhagic infarct (Figure 5) and 24% with ischemic infarct (Figure 6).

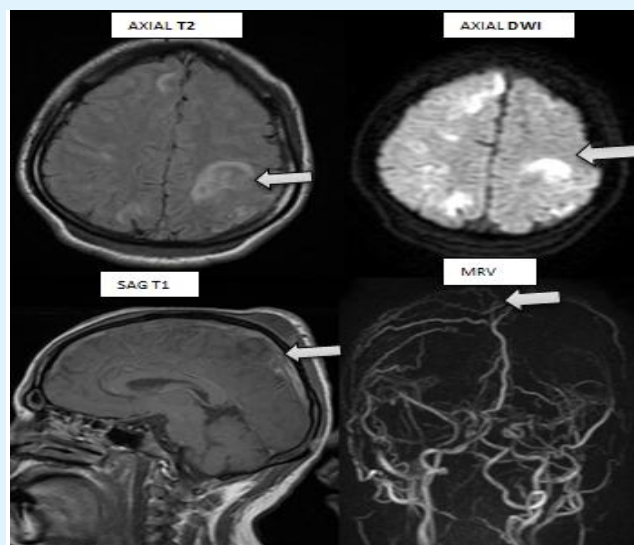


Figure 4: 23 y old women with 5 months of amenorrhea day, c/o headache, Axial T2 FLAIR, DWI, Sag T1 and MRV reveals venous infarct in bilateral frontal lobe secondary to thrombosis of superior sagittal and bilateral transverse sinuses.

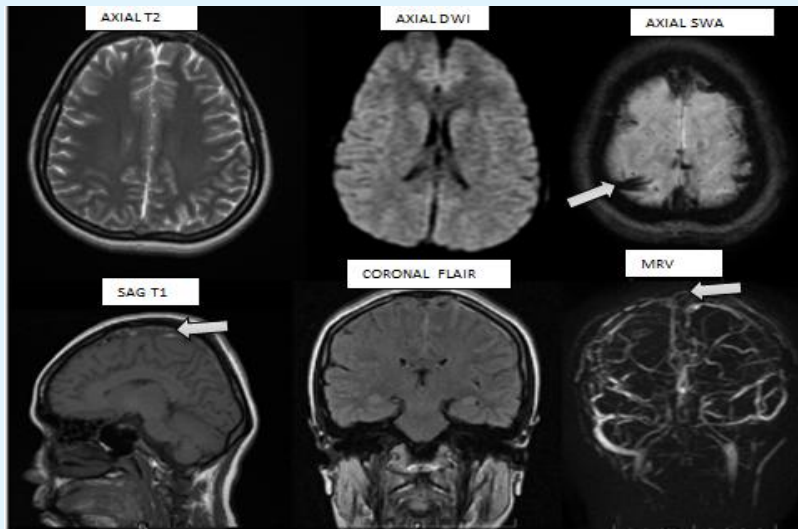


Figure 5: 20 year old lady with h/o head ache on post partum day 5. Non visualisation of superior sagittal, inferior sagittal, straight sinus, both transverse and left sigmoid sinuses on MRV with corresponding high signal on T1 images - in keeping with cortical venous thrombosis. On SWAN images, there is suggestion of blooming involving high parasagittal veins and superior sagittal sinus.

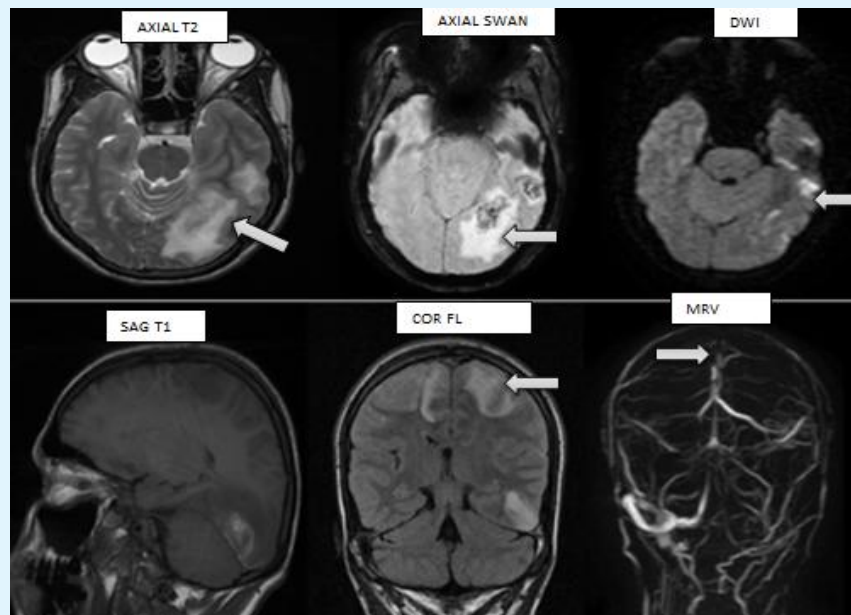


Figure 6: 24 year old lady with h/o head ache on post-partum 17th day, Axial T2, SWAN, DWI, Sag T1, Coronal T2 FLAIR and MR Venography reveals haemorrhagic venous infarct with perilesional edema is seen in the left temporal lobe secondary to CVT. MRV shows intrinsic filling defects in superior sagittal sinus, left transverse, sigmoid sinus, IJV and superficial cortical veins.

Being hyper coagulable state, women in pregnancy and puerperium are population prone for both ischemic and hemorrhagic stroke. Strokes, both ischemic and hemorrhagic are major contributor to morbidity and

mortality during pregnancy and the puerperium. The overall incidence of ischemic stroke during pregnancy and postpartum is low (3.5-5 per 100 000 pregnancies in the developed world) [15]. But it has to be considered

that when compared to stroke in the young as a broader group those related to pregnancy accounted for 12% to 35% of events in this otherwise low-risk population [16].

In our study only 8.8% of patients presented with CVA with Ischemic stroke (63.5%) being predominant over hemorrhagic (Figure 7).

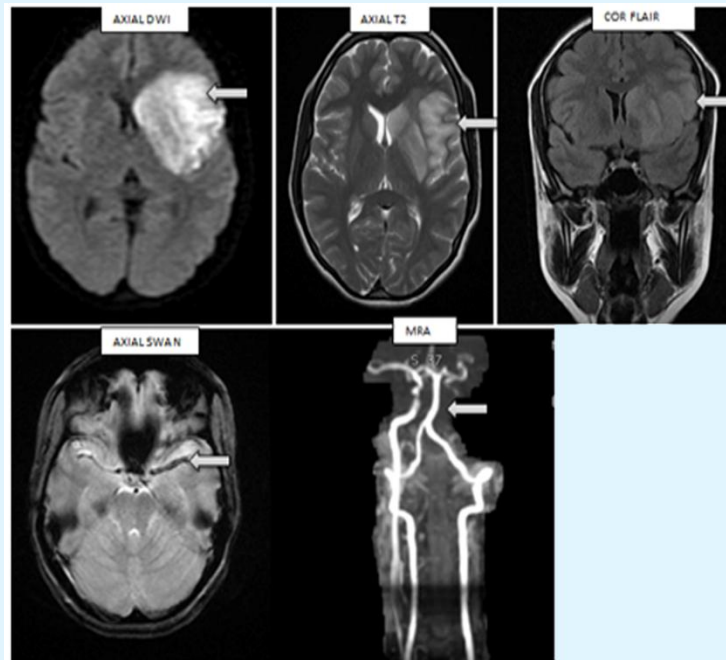


Figure 7: 25 year old woman with 9 months of amenorrhea with right sided weakness, Axial DWI, T2, Coronal T2 FLAIR, SWAN and MRA shows left MCA territory infarct secondary to thrombosis involving left ICA and MCA.

Meningitis and meningoencephalitis are common in peripartum period due to obstetric spinal anaesthesia and secondary to retained products of conception leading to sepsis. Patients presents with complaints of fever, headache and seizures. Out of 105 patients, 5 patients had features of meningoencephalitis with enhancing meninges & parenchymal signal changes on contrast enhanced MRI.

## Conclusion

The dynamic changes occurring during pregnancy and puerperium may induce a variety of non-obstetric complications in central nervous system. A deep understanding of the imaging findings associated with these various conditions and their patho physiological relevance to pregnancy is needed.

Timely imaging and familiarising the radiological features of acute neurological disorder in women during pregnancy and puerperium is needed for initiating early therapy and preventing complications for both the mother and the fetus. And further follow up imaging in cases of PRES helps to confirm the reversal of pathology.

Although complete resolution can be seen over a wide range of 8 days-4 years [17], we recommend follow up imaging by 2-4 weeks following the diagnosis.

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