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Original research article

Role of MRI in detection of neurological manifestations in pregnant women with preeclampsia and eclampsia during pre and post-partum period

[1]Dr. N. Swathi, [2]Dr.Tummala Nageswara Rao, [3]Dr. D. Ankamma Rao

[1]M.D Assistant Professor, Department of Radiology, Gayatri Vidya Parishad Institute of Health Care and Medical Technology, Visakhapatnam, Andhra Pradesh, India

[2]M.D Professor and HOD, Department of Radiodiagnosis, NRI Institute of Medical Sciences, Visakhapatnam, Andhra Pradesh, India

[3]DMRD, DNB, Professor, Department of Radiodiagnosis, NRI Medical College, Mangalagiri, Guntur, Andhra Pradesh, India

Corresponding Author:

Dr. N. Swathi (swathin0808@gmail.com)

Abstract

MRI is more sensitive than CT in identifying changes related to preeclampsia/eclampsia. In normal pregnancy, choline decreases with an ensuing increase in the NAA/choline ratio. The lower level of choline in pregnancy may be a reflection of reduced stores throughout the body because of demands made by the fetus. Few studies have reported spectroscopy in pregnancy related hypertension and they contribute important information regarding the pathogenesis of the central nervous system. Patients who were referred clinically to the Department of Radiology, NRI general hospital with clinical diagnosis of preeclampsia and eclampsia were imaged. MR imaging was performed with a clinical 1.5T Signa Excite system (General electrical medical systems, Milwaukee, USA). A dedicated eight channel high resolution head coil was used. Out of the 50 patients studied in this study 30 patients showed abnormal brain findings on MRI whereas MRI of 20 patients was normal.

Keywords: MRI, neurological manifestations, pregnant women

Introduction

Vasospasm is the primary event leading to eclampsia. This presumption is based on the angiographic appearance of diffuse or multifocal segmental narrowing or vasospasm of the cerebral vasculature. Abnormal findings consistent with vasospasm of large and medium-sized cerebral arteries in the absence of underlying intracranial hemorrhage have been found upto two weeks postpartum in women with severe preeclampsia and eclampsia [1, 2].

Non-lethal intracranial hemorrhage is also frequently found in preeclamptic women who undergo neuroimaging due to an abnormality on neurological examination. Cerebral hemorrhage is more common in older women with underlying chronic hypertension. The cause of such hemorrhages is known to be due to longstanding hypertension-induced lipohyalinosis, which damages small or medium sized cerebral arteries. The striatocapsular area, thalamus, cerebellum and brain stem are the sites most frequently affected in such hypertensive intracerebral hemorrhage. Alternatively, as described cerebral infarction may transform into a hemorrhagic infarction. Such intracerebral hemorrhage may be more common in young nulliparae who present with HELLP syndrome and eclampsia although this is speculative. Only rarely, is intracerebral hemorrhage in women with preeclampsia due to a ruptured aneurysm or arteriovenous malformation [3, 4].

Occasionally, subarachnoid hemorrhage is reported in preeclampsia. In such cases a small amount of blood is seen over the convexity of the frontal/parietal lobes extending into the sylvian fissure or interhemispheric fissure. Conventional angiography rules out ruptured arterial-venous malformation or intracranial aneurysm, or cortical venous sinus thrombosis. Subarachnoid hemorrhage in preeclampsia is hypothesized to be the result of rupture of cortical petechiae over the surface of the brain or rupture of small pial veins. This type of subarachnoid hemorrhage seems to carry a benign prognosis since none of the patients described developed permanent neurologic deficits on follow-up examinations [5].

MRI is more sensitive than CT in identifying changes related to preeclampsia/eclampsia. In normal pregnancy, choline decreases with an ensuing increase in the NAA/choline ratio. The lower level of choline in pregnancy may be a reflection of reduced stores throughout the body because of demands made by the fetus. Few studies have reported spectroscopy in pregnancy related hypertension and they contribute important information regarding the pathogenesis of the central nervous system. Preeclampsia is associated with a lower NAA/choline ratio compared with healthy pregnancy due to increased choline.

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This occurs particularly in edematous areas of the brain where T2 hyperintensity is apparent. The findings of higher choline with equivalent NAA in preeclampsia is thought to reflect relative cerebral ischemia without infarction. Absence of a lactate peak implies there is sufficient circulation to the cells within the brain to provide adequate oxygen and remove the products of anaerobic metabolism. In this situation ischemia is not severe enough to cause loss of neurons or build-up of lactate but is enough to cause membrane degradation and release of choline-containing compounds. The findings in women with preeclampsia are similar to those outside pregnancy. The findings suggest that a normal process of adaptation has not occurred in women who develop preeclampsia or alternatively, these spectroscopic findings reflect cerebral ischemia [6].

More recently, magnetic resonance imaging techniques have been developed that do allow for accurate determination of absolute blood flow. Velocity-encoded phase contrast MRI has been used to measure flow in the intracranial circulations.

Methodology

This study was conducted in 50 patients who were referred clinically to the Department of Radiology with features of preeclampsia and eclampsia.

Sample size & type of study

50 patients clinically diagnosed as preeclampsia and eclampsia were included in our study. Prospective observational study was performed.

Inclusion criteria

All patients who are diagnosed to have preeclampsia (hypertension that is systolic ≥140mmHg and/or diastolic ≥90 mmHg and proteinuria) and superimposed eclampsia (seizures or coma) are imaged.

Exclusion criteria

- Patients who are known hypertensive.
- Patients with known epileptic disorder.
- Patients with pacemakers, aneurysmal clips and claustrophobia were excluded from the study.

Examination technique

- Patients from November 2013 to September 2015 who were referred clinically to the Department of Radiology, NRI general hospital with clinical diagnosis of preeclampsia and eclampsia were imaged. MR imaging was performed with a clinical 1.5T Signa Excite system (General electrical medical systems, Milwaukee, USA). A dedicated eight channel high resolution head coil was used.

Study parameters being monitored

1. Clinical features and clinical diagnosis.
2. MRI BRAIN-evaluation of findings like patterns of regional atrophy, signal changes or microstructural changes in T2 & FLAIR in basal ganglia, pons, midbrain, middle and superior cerebellar peduncles and cerebral subcortical white matter.

Results

Table 1: Incidence of MRI Brain Changes

	Number of Cases	Percentage
Normal	20	40%
Abnormal	30	60%

Out of the 50 patients studied in this study 30 patients showed abnormal brain findings on MRI whereas MRI of 20 patients was normal.

Table 2: Incidence of Abnormal Changes

	Number of Cases	Percentage
PRES	18	60%
Others	12	40%
Total	30	100%

Out of the 30 abnormal MRI findings 18 patients had findings of PRES, which is the most common manifestation in preeclampsia and eclampsia in this study.

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Table 3: Other MRI Brain Changes Excluding PRES

	Number of Cases	Percentage
CSVT	5	41.6%
SAH	2	16.6%
Infarct	1	8.3%
Granuloma	2	16.6%
Cavernoma	1	8.3%
Choroidal fissure cyst	1	8.3%
Total	12	100%

Table 4: Incidence of PRES in Various Regions of Brain

	Number of Cases	Percentage
Frontal	10	20%
Parietal	13	26%
Temporal	7	14%
Occipital	15	30%
Cerebellum	5	10%
Basal ganglia	2	4%

The occipital region followed by the parietal region is the most commonly affected region in PRES.

Discussion

In this study 50 cases of preeclampsia and eclampsia were included and MRI of brain was done. It was a prospective study for a period of 2 years. Each patient fulfilled the diagnostic criteria for preeclampsia with hypertension (more than 140/90 mm of Hg), proteinuria, peripheral edema and for eclampsia with superimposed seizures. None of them had a previous history of seizures. MRI was done using 1.5T Signa Excite system (General electrical medical systems). T1W, T2W, FLAIR, DWI, GRE, MRV & MRA were done for each case. Contrast was not given in any of the cases.

In this study the youngest patient was 18 years old and eldest was 35 years old. The peak age group is between 21-25 years. The incidence is more common in primigravida and in third trimester (78%). Most common symptoms in this study are headache (58%), seizures (34%), blurring of vision (28%) and pedal edema (24%).

MRI brain showed abnormal changes in 30 out of 50 cases. 18 of them showed hyperintensities in subcortical white matter of occipital, parietal, frontal, temporal lobes and cerebellar hemispheres on T2 and FLAIR sequences. DWI showed hypointensities in 14 out of 18 cases which showed hyperintensities on T2W and FLAIR. ADC mapping showed hyperintensities corresponding to hypointensities on DWI. These changes are suggestive of reversible vasogenic edema. In patients presenting with blurring of vision, the changes were seen in occipital lobes. One of the 18 cases of PRES showed hemorrhage in the posterior parietal region.

12 cases showed other MRI brain changes. CSVT in 5 cases, SAH in two cases, granuloma in two cases, infarction in one case, cavernoma in one case and choroidal fissure cyst in one case.

Out of the 15 patients who presented with eclampsia, seizures occurred in the antenatal period in 7 patients (46.6%), in the intrapartum period in 3 patients (20%) and in the post-partum period in 5 patients (33.3%). Seizures occurred at the gestational age of 24 weeks in 1 patient, 29 weeks in one patient, 31 weeks in one patient, 32 weeks in one patient, 33 weeks in two patients, 34 weeks in 4 patients, 35 weeks in one patient, 36 weeks in three patients and at 37 weeks in one patient.

According to report on the national high blood pressure working group on high blood pressure in pregnancy Am J Obstet Gynecol 2000, presence of both cytotoxic and vasogenic edema, are seen in women with eclampsia and the regions of cytotoxic edema are indicative of cerebral infarction. In this study one case showed cytotoxic edema indicating infarction [7].

According to Drislane 1997, occasionally subarachnoid hemorrhage is reported in preeclampsia. In such cases a small amount of blood is seen over the convexity of the frontal/parietal lobes extending into the sylvian fissure or interhemispheric fissure. Subarachnoid hemorrhage in preeclampsia is hypothesized to be the result of rupture of cortical petechiae over the surface of the brain or rupture of small pial veins. Conventional angiography rules out ruptured arterial-venous malformation or intracranial aneurysm, or cortical venous sinus thrombosis. This type of subarachnoid hemorrhage seems to carry a benign prognosis since none of the patients described developed permanent neurologic deficits on follow-up exam. In this study 2 cases showed SAH [8].

According to Patil MM. (2013) in a prospective study of 30 patients, neuro imaging in refractory eclampsia patients have found various CNS abnormalities like cerebral edema (Mild-56%, Severe-10%), hypertensive encephalopathy (16%), posterior reversible encephalopathy syndrome (36%), cerebral infarction (13%), Cortical venous sinus thrombosis (16%), tuberculomas (6%), meningitis (3%), hydrocephalus (3%) and normal study in 13% of case. In this study on pre-eclampsia and eclamsia we

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have found various CNS abnormalities like, posterior reversible encephalopathy syndrome (36%), cerebral infarction (4%), Cortical venous sinus thrombosis (10%), granulomas (4%), SAH (4%), cavernoma (2%), choroidal fissure cyst (2%) and normal study in 40% of cases [1].

Conclusion

- 30 cases showed abnormal MRI brain changes.
- 18 cases showed changes of progressive reversible leukoencephalopathy and 12 cases showed other MRI brain changes.
- The lesions in 18 cases of PRES are hyperintensities in subcortical white matter on T2W and FLAIR and did not show hyperintensities on DWI. So they are due to reversible vasogenic edema.

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