

## Original Research

### Clinicoradiological profile of cerebrovascular disease in hypertensive disease of pregnancy

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#### ABSTRACT:

**Background:** Hypertension in pregnancy has long been recognized as a risk factor for cerebrovascular, cardiac, and renal complications occurring during pregnancy and immediately postpartum. For evaluation of cerebrovascular disease, several imaging studies are available to evaluate the parenchyma, vessels, and extraparenchymal spaces, including computed tomography (CT) with or without ionic contrast, CT angiography or CT venography, magnetic resonance imaging with or without contrast, magnetic resonance angiography, or magnetic resonance venography. The present was done study to assess the clinic-radiological outcome of cerebrovascular diseases in peripartum females. **Material and methods:** This prospective observational study was carried out on 50 antenatal and postnatal women in the department of Medicine in collaboration with Obstetrics and Gynaecology and Radiodiagnosis department of GGS medical college & hospital. Obstetric data such as parity, antenatal care, gestational age at the onset of symptoms and the presence of complications like Preeclampsia, eclampsia, anemia, and sepsis were noted. **Results:** Amongst 50 patients, 35 patients had normal MRI/ CT findings. 15 patients reported with MRI/ CT findings such as Posterior Reversible Encephalopathy Syndrome, Multiple Embolic Infarcts With Haemorrhagic Transformation, Intracerebral Hemorrhage, Infarct In Occipital Lobe, Subarachnoid Haemorrhage, Infarct in Basal Ganglia, Intracranial Haemorrhage with Interventricular Haemorrhage, Basal Ganglia Calcification, Acute Infarct With Haemorrhagic Transformation In Right Frontoparietal Lobe And Insula and Cerebral Vein Thrombosis. The maximum numbers of MRI/ CT findings were seen in grade III hypertension. The result was significant at  $p < 0.05$ . **Conclusion:** Hypertension has emerged as an important risk factor for the occurrence of cerebrovascular disease; therefore, attention should be focussed on rapid control of hypertension and maintaining normotension in the peripartum period.

**Key words:** cerebrovascular disease, Hypertension in pregnancy, Intracerebral Hemorrhage.

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#### INTRODUCTION:

Hypertension, defined by a blood pressure (BP) of 140/90 mmHg or more, affects up to 8% of pregnancies and includes a spectrum of conditions namely; gestational hypertension preeclampsia-eclampsia, preeclampsia superimposed on chronic hypertension, chronic hypertension, and.<sup>1</sup> Hypertension in pregnancy has long been recognized as a risk factor for cerebrovascular, cardiac, and renal

complications occurring during pregnancy and immediately postpartum.<sup>2</sup> Cerebrovascular disorders can be classified into ischemic stroke, subarachnoid hemorrhage, eclamptic encephalopathy, postpartum cerebral angiopathy, and cerebral venous thrombosis.<sup>3</sup> For evaluation of cerebrovascular disease, several imaging studies are available to evaluate the parenchyma, vessels, and extraparenchymal spaces, including computed tomography (CT) with or without

ionic contrast, CT angiography or CT venography, magnetic resonance imaging with or without contrast, magnetic resonance angiography, or magnetic resonance venography. Other studies those are helpful in diagnosing the mechanism of disease are electrocardiography, transesophageal echocardiography with or without agitated saline echo contrast, and transcranial Doppler. In selected cases, conventional arteriography or lumbar puncture may provide additional information; these studies are typically helpful in evaluating for inflammation (arteriography and lumbar puncture) or infection (lumbar puncture). Radiation exposure is always a concern to the clinician caring for the pregnant patient because of the teratogenic effects of radiation exposure.<sup>4</sup>

Under the light of above mentioned data, we planned the present study to assess the clinic-radiological outcome of cerebrovascular diseases in peripartum females.

**MATERIAL AND METHODS**

The present study was carried out in the department of Medicine in collaboration with Obstetrics and Gynaecology and Radiodiagnosis department of GGS medical college & hospital. A total of 50 patients were selected after meeting the inclusion criteria. A detailed history was taken and clinical examination was done. The study was carried out after seeking permission from institutional ethical committee and written consent was obtained from all the patients before starting of the study.

**Inclusion criteria for the present study**

1. Peripartum females with history of hypertension.

**Exclusion criteria for the present study**

1. Patients with history of any systemic illness,
2. Patients with history of any benign or malignant neoplasm involving central nervous system,
3. Patients with cardiac pacemakers or in which MRI is contraindicated.
4. Patients who were not willing to participate in the study.

Obstetric data such as parity, antenatal care, gestational age at the onset of symptoms and the presence of complications like Preeclampsia, eclampsia, anemia, and sepsis were noted.

The following investigations were carried out on all patients: complete Hemogram, Platelet count, Mean platelet volume and Renal function tests, Fundus examination was done. The CT Scan or MRI scan was done in the department of Radiodiagnosis. The non contrast CT scan was done on 128 slice Siemens perspective AS model. Three mm arterial sections were taken. MRI scan was done on Siemens Avanto system. T1W, T2W, FLAIR and DWI/ADV and SWI axial and coronal sequences were done with 3 mm slice thickness. MR venogram and MR Angiography was done if required. CT was done for postpartum patients. MRI was done for antepartum patients.

**RESULTS AND OBSERVATIONS:**

**TABLE 1: AGE DISTRIBUTION**

| Age (years)   | Number of patients (50) | Percentage |
|---------------|-------------------------|------------|
| ≤20           | 3                       | 6%         |
| 21 – 30       | 41                      | 82%        |
| > 30          | 6                       | 12%        |
| Mean age ± SD | 25.26 ± 4.81            |            |
| Minimum age   | 18 years                |            |
| Maximum age   | 38 years                |            |

**TABLE 2: DISTRIBUTION OF GESTATIONAL AGE**

| Gestational age  | Number of patients | Percentage |
|------------------|--------------------|------------|
| Gestation period | 21                 | 42%        |
| Post natal       | 29                 | 58%        |
| Mean ± SD        | 34.14±2.7          |            |

**TABLE 3: PRESENTING SYMPTOMS WITH MEAN DURATION**

| Presenting symptoms           | Number of patients | Mean duration (days) |
|-------------------------------|--------------------|----------------------|
| Seizures                      | 28(56%)            | 1.32                 |
| Blurred Vision                | 14(28%)            | 1.35                 |
| Severe Headache               | 3(6%)              | 1.6                  |
| Unconsciousness               | 2(4%)              | 1                    |
| Sudden Loss of Vision         | 1(2%)              | 1                    |
| Weakness on Left Side of Body | 1(2%)              | 1                    |
| Altered Sensorium             | 1(2%)              | 1                    |

**TABLE 4: DISTRIBUTION OF HAEMOGLOBIN**

|                  | Range       | No. of patients | Percentage |
|------------------|-------------|-----------------|------------|
| Normal Hb        | >10         | 22              | 44%        |
| Mild anaemia     | 8.1-10 g/dl | 14              | 28%        |
| Moderate anaemia | 6.5-8 g/dl  | 12              | 24%        |
| Severe anaemia   | <6.5 g/dl   | 2               | 4%         |
| Mean Hb ± SD     | 9.6±1.6     |                 |            |

**TABLE 5: DISTRIBUTION OF PATIENTS ACCORDING TO GRADE OF HYPERTENSION**

| Grade of hypertension | Systolic BP (mmHg) | Diastolic B.P (mmHg) |
|-----------------------|--------------------|----------------------|
| Grade I               | 140 – 159          | 90-99                |
| Grade II              | 160- 179           | 100 – 109            |
| Grade III             | >180               | >110                 |

  

| Grade of hypertension | Number of patients | Percentage |
|-----------------------|--------------------|------------|
| Grade I               | 17                 | 34%        |
| Grade II              | 17                 | 34%        |
| Grade III             | 16                 | 32%        |

**TABLE 6: MEAN SERUM CREATININE AND SERRUM UREA LEVELS LEVELS (MG/DL)**

|      |                  | Grade I hypertension | Grade II hypertension | Grade III hypertension | P value |
|------|------------------|----------------------|-----------------------|------------------------|---------|
| Mean | Serum Creatinine | 0.66±0.13            | 0.71± 0.26            | 0.78±0.20              | 0.3     |
|      | Serum Urea       | 26.94±10.73          | 29.23±6.10            | 30.70±5.7              | 0.39    |

**TABLE 7: FUNDOSCOPY**

| FUNDOSCOPY                       | Grade I hypertension | Grade II hypertension | Grade III hypertension | P value |
|----------------------------------|----------------------|-----------------------|------------------------|---------|
| Normal                           | 15                   | 14                    | 10                     | 0.46    |
| Hypertensive Retinopathy Grade 1 | 1                    | 2                     | 4                      |         |
| Hypertensive Retinopathy Grade 2 | 1                    | 1                     | 2                      |         |

**TABLE 8: RETINOPATHY WITH MRI/CT FINDINGS**

Total number of patients having retinopathy = 11

|   | Grade I hypertension | Grade II hypertension | Grade III hypertension | P value |
|---|----------------------|-----------------------|------------------------|---------|
| Normal MRI/CT findings with retinopathy   | 1                    | 1                     | 2                      | 0.90    |
| Abnormal MRI/CT findings with retinopathy | 1                    | 2                     | 4                      |         |

**TABLE 9: MATERNAL AND FETAL MORTALITY**

| Mortality          | Grade I hypertension | Grade II hypertension | Grade III hypertension |
|--------------------|----------------------|-----------------------|------------------------|
| Maternal mortality | 0                    | 0                     | 2                      |
| Fetal mortality    | 1                    | 0                     | 2                      |

**TABLE 10: MRI/CT FINDINGS**

|  | Grade I hypertension | Grade II hypertension | Grade III hypertension | total |
|--|----------------------|-----------------------|------------------------|-------|
| Normal   | 15                   | 13                    | 7                      | 35    |
| Posterior Reversible Encephalopathy Syndrome   | 1                    | 2                     | -                      | 3     |
| Multiple Embolic Infarcts With Haemorrhagic Transformation                             | -                    | -                     | 1                      | 1     |
| Intracerebral Hemorrhage   | -                    | 1                     | 1                      | 2     |
| Infarct In Occipital Lobe  | -                    | 1                     | 1                      | 2     |
| Subarachnoid Haemorrhage   | -                    | -                     | 1                      | 1     |
| Infarct In Basal Ganglia   | -                    | -                     | 2                      | 2     |
| Intracranial Haemorrhage With Interventricular Haemorrhage                             | -                    | -                     | 1                      | 1     |
| Basal Ganglia Calcification  | 1                    | -                     | -                      | 1     |
| Acute Infarct With Haemorrhagic Transformation In Right Frontoparietal Lobe And Insula | -                    | -                     | 1                      | 1     |
| Cerebral Vein Thrombosis   | -                    | -                     | 1                      | 1     |

**TABLE 11: NORMAL AND ABNORMAL MRI/CT FINDINGS**

|                          | Grade I hypertension | Grade II hypertension | Grade III hypertension |
|--------------------------|----------------------|-----------------------|------------------------|
| Normal MRI/CT findings   | 15                   | 13                    | 7                      |
| Abnormal MRI/CT findings | 2                    | 4                     | 9                      |

**DISCUSSION**

In this study Total of 50 Peripartum females with history of hypertension were included. The youngest patient reported is 18 years old and eldest patient reported is 38 years. Maximum numbers of patients were in the age group 25 – 30 years. Zibaenazhad MJ et al<sup>5</sup> stated that Age has an important influence on the incidence of hypertensive disorders of pregnancy. The mean age of patients was 25.26 years. Prabhu T and Bai R<sup>6</sup> stated that at in their study at presentation mean was 22 years. Bashiri A et al<sup>7</sup> in their study of Maternal and neonatal outcome following Cerebrovascular Accidents during Pregnancy reported that Mean maternal age at diagnosis was 28 years. The mean age reported by these studies is almost similar to our study.

The maximum numbers of patients reported in our study were from post natal period (58%) and patients. In case of antenatal patients the mean gestational age was 34.14 weeks.

In their study Bashiri A et al<sup>7</sup> reported mean gestational age of 35.7 weeks in case of singleton pregnancies and 34 weeks in cases of twins.

It was reported by Srinivasan K<sup>8</sup> that CVT occurring in the puerperium is about 10–12 times more frequent in India than in western countries. The possible reasons for the high incidence in Asian countries could be due to coexistent severe anemia and the local custom of fluid restriction during puerperium.<sup>6</sup> Many studies have shown that the risk of stroke is high in the postpartum period.<sup>9-11</sup>

In this study most of the patients presented with seizures in 28 cases (56%), followed by blurred vision in 14 cases (28%), severe headache in 3 cases (6%), Unconsciousness in 2 cases (4%) and sudden loss of vision, Weakness on Left Side of Body and altered sensorium in one case each (2%). The mean duration of seizures is 1.32 days, blurred vision is 1.35 days, and severe headache is 1.6 days. Duration of Unconsciousness, sudden loss of vision, Weakness on Left Side of Body and altered sensorium is 1 day.

In their study Prabhu T and Bai R<sup>6</sup> reported that the most common presenting symptom was seizure and was seen in 24 cases (92 %). Intense headache was present in two cases (7.7 %) prior to the stroke. Fever with high temperature was seen in 3 cases (11.5 %) and one of them had intrapartum sepsis. 17 patients were at varying stages of altered sensorium, varying from semiconsciousness to an unconscious state. Three patients presented with psychotic behavior. Hemiparesis/hemiplegia was seen in 20 cases (76.9 %).

In their study Sajith M et al<sup>12</sup> stated that patients with hypertensive disorders of pregnancy reported with symptoms such as severe headache in 20 (19.2%) cases, Epigastric Pain in 18 (17.3%) cases,

peripheral edema in 14 (13.5%) cases, Seizures in 4 (3.8%) cases and blurring vision in 2 (1.9%) cases.

Anemia is also an important contributory factor for the development of cerebrovascular complications.<sup>6</sup> In this study 22 (44%) cases had normal haemoglobin. Mild anaemia was present in 14 (28%) cases had mild anaemia, 12 (24%) of cases had moderate anaemia and severe anaemia was present in 2 (4%) cases. Prabhu T and Bai R<sup>6</sup> in their study reported that 7 of the 26 cases (27 %) suffered from anemia. Wiebers DO<sup>13</sup> pointed that anemia during epidural anesthesia may predispose to cerebral events.

In this study 17 (34%) females had Grade I hypertension, 17 (34%) females had Grade II hypertension and 16 (32%) females had Grade III hypertension.

Renal dysfunction in these disorders is due to glomerular endothelial injury causing decrease in GFR. Various studies have mentioned elevated levels of renal markers, such as serum uric acid, creatinine, and urea in PE.<sup>14</sup>

In this study the mean serum creatinine levels in Grade I hypertension was 0.66mg/dl, in Grade II hypertension was 0.71 mg/dl and in Grade III hypertension was 0.78 mg/dl. With increasing grade of hypertension the serum creatinine levels also increased but there was no significant difference in mean serum creatinine levels amongst three groups of hypertension. Serum creatinine levels are a part of work up for the pregnant women with hypertension. The elevated levels of serum creatinine were due to decreased urinary clearance secondary to reduced GFR and increased reabsorption.<sup>15</sup> Various studies have reported elevated levels of serum creatinine in hypertensive disorders of pregnancy.<sup>16-18</sup>

In this study the mean serum urea levels in Grade 1 hypertension was 26.94 mg/dl, in Grade 2 hypertension was 29.23 mg/dl and in Grade 3 hypertension was 30.70 mg/dl. With increasing grade of hypertension the serum urea levels also increased but there was no significant difference in mean serum urea levels amongst three groups of hypertension.

The pathological changes of pregnancy induced hypertension disease appear to be related to vascular endothelial dysfunction and its consequences (generalized vasospasm and capillary leak). The retinal vascular changes generally, but not always, correlate with the severity of systemic hypertension. Vasospastic manifestations are reversible and the retinal vessels rapidly return to normal after delivery.<sup>19</sup>

In this study amongst grade I hypertensive patients' one patient had Hypertensive Retinopathy Grade 1 and one patient had Hypertensive Retinopathy Grade 2. 15 patients were normal. Amongst grade II hypertensive patients' two patients

had Hypertensive Retinopathy Grade 1 and one patient had Hypertensive Retinopathy Grade 2. 14 patients were normal. Amongst grade III hypertensive patients' four patients had Hypertensive Retinopathy Grade 1 and two patients had Hypertensive Retinopathy Grade 2. 10 patients were normal. There is no statistically significant difference among three grades of hypertension and presence or absence of retinopathy.

In present study retinopathy was present in 4 patients with Normal MRI/CT findings and 7 patients with Abnormal MRI/CT findings.

The prevalence of hypertensive retinopathy changes (22%) seen in our study is higher than 13.7%<sup>20</sup>, 21.5%<sup>21</sup> but lower than 45%<sup>22</sup> as reported in the literature.

It was reported by Prabhu T and Bai R<sup>6</sup> in their study that Fundus examination was normal in 15 cases (57.7 %), Grade II retinopathy in 5 cases (19.2 %), Grade III retinopathy in 2 cases (7.7 %).

In this study maternal mortality rate was 2 (4%) and fetal mortality rate was 6%. The two patients who died had intracerebral haemorrhage and intracranial haemorrhage with interventricular haemorrhage on MRI/CT findings.

Pregnancy induced hypertension is a major contributors to maternal and perinatal morbidity and mortality. In the United States, about 15% of maternal deaths are attributable to hypertension, making it the second leading cause of maternal mortality. Severe hypertension increases the mother's risk of cardiac failure, heart attack, renal failure and cerebral vascular accidents. In addition, the fetus is at increased risk from complications like poor placental transfer of oxygen, growth restriction, preterm birth, placental abruption, stillbirth and neonatal death. Hypertensive disorders represent the most common medical complications of pregnancy with a reported incidence of 5-10%.<sup>23</sup>

Amongst all the patients included in our study 35 patients had normal MRI/ CT findings. 15 patients reported with MRI/ CT findings such as Posterior Reversible Encephalopathy Syndrome, Multiple Embolic Infarcts With Haemorrhagic Transformation, Intracerebral Hemorrhage, Infarct In Occipital Lobe, Subarachnoid Haemorrhage, Infarct in Basal Ganglia, Intracranial Haemorrhage with Interventricular Haemorrhage, Basal Ganglia Calcification, Acute Infarct With Haemorrhagic Transformation In Right Frontoparietal Lobe And Insula and Cerebral Vein Thrombosis.

Amongst grade I hypertension 2 patients had abnormal MRI/ CT findings, Amongst grade II hypertension 4 patients had abnormal MRI/ CT findings. Amongst grade III hypertension 9 patients had abnormal MRI/ CT findings. The maximum numbers of MRI/ CT findings were seen in grade III hypertension. The chi-square statistic is 8.3. The p-value is 0.015. The result is significant at  $p < 0.05$ .

Posterior reversible encephalopathy syndrome (PRES) is a clinically recognizable entity

that presents with neurologic signs and symptoms (headache, altered consciousness, visual abnormalities, and seizures) in conjunction with the unique neuroimaging findings of vasogenic edema involving the posterior circulation. An association between eclampsia and PRES was first described by Hinchey J et al<sup>24</sup> in 1996.

Posterior Reversible Encephalopathy Syndrome was present in 3 cases in present study. Wagner SJ et al<sup>25</sup> in their study reported that 3 of 15 patients with PRES had eclampsia, with other etiologies including hypertensive encephalopathy and immunosuppressive medications.

Intracerebral hemorrhage (ICH) is an infrequent but severe complication in pregnant women with hypertension.<sup>26</sup> Intracerebral Hemorrhage was present in 2 cases in our study. Intracerebral haemorrhage has been found in up to 40% of patients with eclampsia in autopsy series.<sup>28</sup> Eclampsia is an important cause of serious haemorrhagic stroke. Skidmore FM et al<sup>27</sup> in an intensive care admission study found that four of 11 pregnant patients admitted with haemorrhagic stroke were eclamptic.

Subarachnoid Haemorrhage was present in one case in our study. The overall frequency of pregnancy-related Subarachnoid Haemorrhage during pregnancy is thought to be 0.01–0.03%.<sup>19</sup> Up to 90% of these Subarachnoid Haemorrhages occur during pregnancy, 2% during delivery and 8% during the puerperium.<sup>2</sup> There appears to be a tendency for a higher frequency of Subarachnoid Haemorrhage with advancing gestation, suggesting that haemodynamic or other physiological changes in pregnancy do influence the rate of aneurysmal growth or rupture.<sup>28</sup>

In our study Cerebral Vein Thrombosis was reported in one case Cerebral Vein Thrombosis during pregnancy and puerperium is a common entity in India.<sup>29</sup> Study by Prabhu T and Bai R<sup>6</sup> has shown that, out of the 26 cases, 17 cases were diagnosed with Cerebral Vein Thrombosis. The high incidence of Cerebral Vein Thrombosis in the Indian population could be due to anemia, sepsis, and the custom of withholding fluid in the puerperium leading to dehydration. In Cerebral Vein Thrombosis, symptoms are caused by the obstruction of cortical veins and superior longitudinal sinus.

15 (30%) cases in our study showed positive MRI/CT findings for cerebrovascular complications. With increasing grade of hypertension there is more risk of cerebrovascular complications.

## CONCLUSION:

In this study, hypertension has emerged as an important risk factor for the occurrence of cerebrovascular disease; therefore, attention should be focussed on rapid control of hypertension and maintaining normotension in the peripartum period. In a country like ours, it is also important to correct anemia and avoid dehydration in the peripartum period. There should be greater awareness and liberal

use of CT/MRI in those cases who presented with seizures in the pregnancy/puerperium, and in those cases presenting with loss of consciousness. Early initiation of anticoagulant therapy can prevent further progression of thrombus and infarcts and this will considerably reduce the morbidity and mortality.

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