



## Fundus Changes in Pregnancy-Induced Hypertension

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### ABSTRACT

#### BACKGROUND:

In both industrialized and developing nations, hypertensive problems during pregnancy are regarded as the main cause of maternal morbidity and mortality. It affects 7 to 10% of all pregnancies and is the most frequent medical issue during pregnancy. Differentiating between hypertension caused by pregnancy and hypertension unrelated to pregnancy is the major challenge for clinicians. Anything along the visual system, from the anterior segment to the visual cortex, might be affected by pregnancy. Almost every organ system in the body is impacted by PIH, including the ophthalmic, cardiovascular, renal, endocrine, and central neurological systems. Vasospastic alterations can be reversed, and following delivery, vasospasm in the retinal vessels returns to normal. Severe toxemia causes involvement of the visual system.

**OBJECTIVE:** The objective of this research was to ascertain the frequency of retinal changes in pregnancy-induced hypertension (PIH) and any relationships between the retinal changes and proteinuria, blood pressure, and illness severity.

#### MATERIAL AND METHOD:

This ophthalmology department observational cross-sectional study was conducted. The study included all pregnant women between the ages of 18 and 35 who visited the OPD and were admitted to the hospital's obstetric ward and had systolic blood pressure of more than 140 mm Hg and diastolic blood pressure of more than 90 mm Hg. For 100 cases of PIH with a diagnosis, the study was undertaken. Individuals with preexisting renal illness, diabetes, hypertension, or hazy media that prevented fundus visualization were excluded from the study.

#### RESULTS:

100 patients underwent examination; 65% of PIH cases were discovered in the 21–25 age range. The patients' average age was 23.22 ± 2.2 years. 40% of women were multi-gravida, 60% were primi-gravida. 70% of patients with moderate preeclampsia, 25% with severe preeclampsia, and 5% with eclampsia. 65% of individuals had hypertensive retinopathy, whereas the other 35% had normal fundi. As the patient's hypertension becomes more severe, the likelihood of aberrant fundus findings increases. Results from the fundus and parity were contrasted. Hence, there was no association between the fundus findings and parity.

#### CONCLUSION:

In all situations of pregnancy-induced hypertension, a retinal examination is essential. It is a key factor in deciding whether to end a pregnancy because it is a sign of how severe the fundus finding and hypertension are. A fundus examination is a crucial clinical assessment for PIH patients to anticipate unfavorable fetal outcomes as well as the risk to the mother's life.

**KEYWORDS:** Pregnancy Induced Hypertension; Retinal Changes; Preeclampsia; Eclampsia and Cortical Blindness

**Introduction:**

Pregnancy-induced hypertension (PIH) is a form of hypertension that develops during pregnancy when there are no other known causes of raised blood pressure (140/90 mmHg, a rise in systolic pressure of 30 mmHg or a rise in diastolic pressure of 15 mmHg), when taken twice after rest, and when combined with generalized edema and/or proteinuria. Preeclampsia is the medical name for substantial proteinuria; eclampsia is the medical word for seizures or coma brought on by PIH.<sup>1</sup> A difficult stigma in the field of obstetrics, pregnancy-induced hypertension is one of the leading causes of maternal and neonatal mortality. A number of physiological and pathological changes are related to pregnancy. During 20 weeks of pregnancy and in the absence of other reasons of elevated blood pressure (B.P.), i.e., >140/90 mm Hg measured twice with at least 6-hour intervals, pregnancy-induced hypertension (PIH) develops. PIH is hypertension that arises specifically as a result of being pregnant.<sup>2</sup>

The anterior segment of the visual cortex in the visual pathway can be impacted by pregnancy. The prevalence of ocular involvement in PIH ranges from 30 to 100% in various studies.<sup>3</sup> As severe hypertensive retinopathy calls for pregnancy termination. Preeclampsia, eclampsia, and gestational hypertension all make up PIH.<sup>4,5</sup> Gestational hypertension develops when blood pressure rises to 140/90 mm Hg or above without proteinuria after 20 weeks of pregnancy. Preeclampsia is defined as high blood pressure (140/90 mmHg, or an increase of 30 mmHg in systolic pressure or an increase of 15 mmHg in diastolic pressure), with or without proteinuria and/or pedal edema, after 20 weeks of pregnancy. Severe preeclampsia is characterized by considerable proteinuria, epigastric discomfort, visual problems, liver failure, and CNS disturbances; eclampsia is characterized by seizures or coma in addition to severe preeclampsia.<sup>6</sup> A multisystem condition, PIH manifests as problems in the heart, blood vessels, liver, kidneys, nervous system, and eyes.<sup>7</sup> The involvement of the visual system is typically caused by severe toxemia. The majority of the time, but not always, the retinal vascular alterations are associated with systemic

hypertension. The development of the vascular constriction may take days, and it may last for weeks or months.<sup>8</sup>

Pre-eclampsia in nulliparous women occurs in 3 to 10% of cases globally.<sup>9</sup> Eclampsia affects roughly 1 in 2000 deliveries in industrialized nations compared to 4 in 2000 in developing nations.<sup>10,11</sup> The prevalence of PIH is 15.2% in India. 10% of primigravida and 5% of multigravida experience the incidence.<sup>12,13</sup> Genetic predisposition and immunological processes are among the theories. As the systolic pressure rises beyond 160 and the diastolic pressure rises above 100 mm of Hg, retinal alterations are likely to develop. They become noticeable when these limits reach 200/130 mm of Hg.<sup>14</sup> The condition frequently affects the choroid, which can lead to choroidal ischemia and infarction. Except in cases of substantial infarction, recovery normally occurs after ischemia of the occipital lobe and optic nerve. Visual abnormalities may occasionally be the only symptom present; other, less frequent symptoms include hemianopia, amaurosis, photopsia, scotomata, diplopia, and achromatopsia. The conjunctiva, choroid, optic nerve, and visual cortex can all be impacted, although abnormalities of the retina and retinal vasculature are the most common. Vascular involvement frequently results in visual loss. Central retinal artery occlusion, secondary optic atrophy, macular tear, central serous retinopathy, retinal detachment, central retinal vein occlusion, choroidal ischemia, and hemorrhage are all disorders that can result in vision loss.<sup>15</sup> In order to ascertain the prevalence of retinal changes in PIH and the relationships between the changes in the retina and the severity of the disease, proteinuria, and blood pressure, this study was conducted.

**MATERIAL AND METHODS**

The department of ophthalmology conducted this observational cross-sectional study. All pregnant women between the ages of 18 and 35 who were admitted to the hospital's obstetric ward after visiting the OPD and had a systolic blood pressure of more than 140 mm Hg and a diastolic blood pressure of more than 90 mm Hg were included in the study. 100 PIH cases with a diagnosis were the subject of the study. Individuals who already had diabetes, hypertension, kidney illness, or murky media

that prevented fundus visualization were not included in the study. All patients' baseline data were logged after receiving informed consent. An obstetrician conducted a preliminary evaluation of each patient. The case sheet was filled out after a thorough history, general physical examination, and systemic examination. Both visual acuity and eye problems in the past were assessed. Counting fingers at a distance of three meters is seen as normal because the majority of the patients were admitted and examined at their bedsides. All patients were told of the study's purpose before giving their consent.

#### **Inclusion Criteria:**

- patients diagnosed with pregnancy-induced hypertension in the age group of 18 – 35 years
- with > 20 weeks of gestation

#### **Exclusion criteria:**

- Patients with pre-existing hypertension
- Pre-existing Diabetes
- Renal pathology
- Ocular pathologies like glaucoma, cataract, corneal opacities, history of ocular trauma, surgery or previous laser treatment, and hazy media which hinders the fundus examination were excluded from the study.
- Patients with cardiovascular diseases.
- Patients with anemia, connective tissue disorders, vasculitis, or any other systemic disease.
- Patients with malignancy, leukemia.

The anterior portion was inspected on the bed itself using a torch light after a history of any eye complaints had been taken. A 1% tropicamide eye drop was used to dilate both pupils, and in a dimly lit room in the ward, an ophthalmologist used a direct ophthalmoscope to examine the fundus. In that patient, hypertensive retinopathy alterations in the right, left, or both eyes were regarded as good findings. The case records contained information on age, race, gravida, para, blood pressure, and proteinuria. Preeclampsia (mild and severe) and eclampsia were the grades assigned to the PIH. On a data sheet, all the findings were recorded. The following biochemical tests were performed: CBC, liver function test, renal function test, standard urine

analysis, 24-hour urine protein analysis, and coagulation profile. The fundus was thoroughly examined using an indirect ophthalmoscope. Fundus modifications were graded using THE KEITH WAGNER BARKER CLASSIFICATION.

- **Group I:** Patients with moderate hypertension have minimal constriction of the retinal arterioles along with modest tortuosity.
- **Group II:** group I individuals with limited or no additional systemic disease who have clear focal constriction and arteriovenous nicking.
- **Group III:** Several of the patients in group II with hemorrhages, exudates, and vasospastic alterations like cotton wool patches and arteriolar attenuation also had observable cardiac, cerebral, or renal failure.
- **Group IV:** group III with optic disc edema, cardiac, cerebral, or renal disease are more severe
- **Mild preeclampsia** - BP > 140/90mmHg, mild edema of legs; and/or proteinuria+1,
- **Severe preeclampsia** -BP >160/110mmHg, cerebral, visual disturbances headache, epigastric pain, LFT dysfunction, raised serum creatinine, uric acid, and blood urea, proteinuria ++ or +++.
- **Eclampsia** -severe preeclampsia +seizures.
- Proteinuria was assessed using dipstix method.

#### **STATISTICAL ANALYSIS**

The results were analyzed using the SPSS program. The chi-square test was used to determine the association between the retinal changes and blood pressure, proteinuria, and severity of PIH. A value <0.05 was taken as significant.

#### **RESULT: -**

100 patients underwent examination; 65% of PIH cases were discovered in the 21–25 age range. The patients' average age was 23.22 ± 2.2 years. 40% of women were multi-gravida, 60% were primi-gravida. 70% of patients with moderate preeclampsia, 25% with severe preeclampsia, and 5% with eclampsia. 65% of individuals had hypertensive retinopathy, whereas the other 35% had normal fundi.

**Table 1: Distribution of patients according to age, gravida, the severity of PIH, and fundus finding**

Age (Years)	Number of Patients	Percentage (%)
≤ 20 years	8	8
>20 -25 years	65	65
>25-30 years	21	21
>30 years	6	6
<b>Gravida</b>		
Primigravida	60	60
Multigravida	40	40
<b>Severity of PIH</b>		
Mild preeclampsia	70	70
Severe preeclampsia	25	25
Eclampsia	5	5
<b>Fundus finding</b>		
Normal	35	35
Hypertensive retinopathy	65	65
<b>Grade of retinopathy</b>		
Grade 1	31	31
Grade 2	22	22
Grade 3	5	5
Grade 4	4	4
Total	100	100

Grade 1 hypertensive retinopathy changes were found in 31% of patients, Grade 2 changes were found in 22%, Grade 3 were found in 5% and grade 4 changes were found in 4%.

**Table 2: Correlation of fundus findings with severity of PIH**

Fundus Finding	Mild pre-eclampsia SBP<160, DBP<110		Severe preeclampsia SBP≥160 DBP≥110		Eclampsia SBP≥160 DBP≥110	
	N	%	N	%	N	%
Normal	35	50.7	0	0	0	0
Grade 1	25	29.3	11	50.0	0	0
Grade 2	13	17.3	6	35	1	20
Grade 3	2	2.7	2	10	1	20
Grade 4	0	0	1	5	3	60
<b>Total</b>	75	100	20	100	5	100

All 100 instances had fundus alterations, and Fisher's exact testing was used to correlate the degree of hypertension. demonstrating their constructive relationship. As the patient's hypertension becomes more severe, the likelihood of aberrant fundus findings increases.

**Table 3: Correlation of fundus findings with parity**

Fundus Finding	Primigravida		Multigravida	
	N	%	N	%
Normal	22	30	16	56.6
Grade 1	26	38.6	5	16.6
Grade 2	15	21.4	7	20
Grade 3	3	4.3	2	6.6
Grade 4	4	5.6	0	0
<b>Total</b>	70	100	30	100

Parity and fundus findings were compared. Hence, the fundus findings had no correlation with parity. Grade +1 proteinuria was seen in 55% of patients, Grade +2 was seen in 34%, and only 10 patients of grade +3 proteinuria. Fundus changes were found and the grade of proteinuria was correlated. There is more chance of abnormalities in the fundus with increasing degrees of proteinuria.

## DISCUSSION

This investigation was done to assess the fundus alterations in patients with eclampsia and pre-eclampsia. In obstetrics, PIH is one of the most frequent causes of morbidity and mortality. 3-5% of pregnancies are affected by PIH, a hypertension condition with multisystem involvement. By directly seeing the ocular fundus, it is possible to study the numerous pathological alterations in various body organs, which may provide a reliable indicator of alterations in the vascular structure of the brain and retina in PIH.<sup>16,17</sup>

In a study done by Shukla et al. in 1965<sup>18</sup>, they looked at 20 preeclampsia and eclampsia cases and found that 70% of the subjects in various age groups had retinal abnormalities. 60% of the cases in their study were under 25 years old. Maternal deaths are caused by pregnancy-induced hypertension, particularly in underdeveloped nations. In Malaysia, eclampsia was the cause of death in 7.8% of cases from 1997 to 2000 and preeclampsia in 4.1%.<sup>19</sup> A group of patients with hypertensive diseases of pregnancy (gestational hypertension, chronic hypertension, preeclampsia/eclampsia, and chronic hypertension with superadded preeclampsia/eclampsia) were studied by Rasdi AR 2011<sup>20</sup> from Malaysia. Preeclampsia/eclampsia was seen in 21.5% (5 out of 28 patients) of cases, resulting in retinal abnormalities. They found generalized arteriolar narrowing (5/28), cotton wool spot (1/28), hemorrhage (1/28), and serous retinal detachment (1/28). They noted the resolution of all the above retinal changes except the narrowing of arteries during the puerperium period.

In a study done by Varija T et al 2016<sup>21</sup> the Majority of cases, 79.6% were in the age group of 20-25 years, which also favors the present study. This result could be because of more pregnant women tend to fall into this age group.

In the study done by Tadin et al 2001<sup>22</sup> from Croatia 55% of mild preeclampsia, 25% of severe preeclampsia, and 20% of eclampsia, were similar to the present study. In a study done by Reddy et al 2012<sup>14</sup> 38.5% of patients with mild preeclampsia, 59% patients of with severe preeclampsia, and 2.5% patients of with eclampsia. Max cases of severe preeclampsia were found. This can be because the patients are unaware of antenatal exams. In the current investigation, 65% of the patients had retinal abnormalities. According to the current study, there is a direct correlation between the severity of pregnancy-induced hypertension and the fundus finding. As pregnancy-induced hypertension becomes more severe, the likelihood of the patient having aberrant fundus findings increases. The study done by Reddy et al 2012<sup>14</sup> includes 78 patients with PIH and showed a prevalence rate of 59%

An major indicator of pre-eclampsia is proteinuria. Preeclampsia must be diagnosed by at least two factors: hypertension and proteinuria, which might be mild or severe. All 100 patients in the current study exhibited proteinuria, which ranged from 1+ to 3+. A patient's risk of getting retinopathy is higher in those with severe proteinuria (3+) than in those with less severe proteinuria.

Z. Kurdoglu et al. 2011<sup>23</sup> found no significant correlation with the severity of disease which was against our observation. Karki et al. 2010<sup>24</sup> evaluated the fetal outcome in these patients and came to the conclusion that fundus evaluation in patients with PIH is an important procedure to predict poor fetal outcomes. Retinal and optic nerve head changes were associated with low birth weight; choroidal and optic nerve head changes were associated with low Apgar score. When monitoring these individuals after delivery, vision is a crucial factor to look for. Exudative retinal detachments are a common symptom of late-onset severe eclampsia and normally go away when the pregnancy is terminated.

Fry W 1929<sup>25</sup> stated in their study that serous retinal detachment occurs in approximately 1% of patients with pre-eclampsia and 10% of those with eclampsia. Reddy et al.<sup>14</sup>, found 6 cases (3%) with retinal hemorrhages and 6 cases (3%) with cotton wool spots belonging to severe pre-eclampsia. The present study suggests a positive

correlation between fundus findings, the severity of hypertension, and grades of proteinuria. This is similar to the study done by **Tadin et al 2001**<sup>22</sup> where he reported that the degree of retinopathy was directly proportional to the severity of preeclampsia and proteinuria. Their study stated that hypertensive retinopathy is the prognostic factor in determining the severity of preeclampsia and that examination of the fundus is valuable and also plays an important role in the diagnosis of preeclampsia. The obstetrician can use the straightforward instrument of ophthalmoscopy to gauge the severity of the disease in PIH instances. Retinal hemorrhages and alterations to the retinal arterioles are generally thought to be indicative of comparable changes in the placenta. An ophthalmoscopic examination of the mother's fundus may provide information about similar microcirculation alterations in the placenta and, indirectly, about the fetal and maternal outcomes, as the health of the fetus depends on placental circulation. An essential clinical assessment to forecast a poor fetal fate in PIH patients is the fundus examination.

#### CONCLUSION:

The most frequent fundus change observed in PIH patients is grade 1 or 2 hypertensive retinopathy. Grade 3 and 4 hypertensive retinopathy is less frequently observed. The current investigation revealed a favorable relationship between pregnancy-related complications including proteinuria and hypertension. However, there was no connection between the patient's age and parity and the fundus discovery. In all situations of pregnancy-induced hypertension, a retinal examination is essential. It is a key factor in deciding whether to end a pregnancy because it is a sign of how severe the fundus finding and hypertension are. A fundus examination is a crucial clinical assessment for PIH patients to anticipate unfavorable fetal outcomes as well as the risk to the mother's life. Many studies have linked the advancement of retinal vascular alterations to both maternal and fetal mortality as well as PIH severity, considering it a symptom of the condition getting worse. Due to the possibility that they mirror similar ischemia vascular alterations in the placenta, these changes serve as a guidance for the termination of pregnancy.

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