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Research Article

# AN EVALUATION OF FUNDOSCOPIC FINDINGS IN PATIENTS OF HYPERTENSIVE DISORDERS OF PREGNANCY

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## ABSTRACT

**Aim:** The aim of the present study was to assess the prevalence of retinal changes in hypertensive disorders of pregnancy and to understand the association between retinal changes and severity of hypertension and proteinuria.
**Methods:** The Observational Analytical Cross-Sectional Study was conducted in the Department of Ophthalmology, MGM Medical College and LSK, Kishanganj for the period of 18 Months. 125 cases were included in the study.
**Results:** The majority of pregnant women with pregnancy-induced hypertension (PIH) were aged 21–25 years (57.6%), followed by 26–30 years (22.4%), suggesting that younger pregnant women are more susceptible to PIH. Most patients with PIH were primigravida (62.4%), while 37.6% were multigravida. A significant proportion of PIH cases (64.8%) occurred after 32 weeks of gestation, while only 3.2% presented between 20–24 weeks, indicating that PIH predominantly manifests in the third trimester. Most patients (64%) had mild hypertension (<150/100 mmHg), while 36% had severe hypertension (≥150/100 mmHg), highlighting that a considerable proportion of PIH cases progress to severe hypertension. Over half of the patients (52%) had mild proteinuria (1+), while 34.4% had moderate (2+) and 13.6% had severe proteinuria (3+), suggesting that proteinuria severity varies widely in PIH.
**Conclusion:** Our study sheds light on the prevalence and impact of hypertensive disorders in pregnancy, emphasizing significant associations between retinal changes and factors such as blood pressure severity, proteinuria, maternal age, and parity. The findings highlight that younger and older maternal ages, primigravida status, advanced gestational age, severe hypertension, and higher grades of proteinuria are key risk factors for retinal involvement. While hypertensive retinopathy was the most common ocular finding, severe retinopathy grades were rare.

***Keywords****: prevalence, retinal changes, hypertensive disorders, pregnancy, retinal changes, hypertension, proteinuria*

## INTRODUCTION

Hypertensive disorders of pregnancy (also known as pregnancy induced hypertension – PIH) is a disorder in pregnancy that occurs in the absence of other causes of elevated blood pressure (140/90 mmHg, or a rise of 30 mmHg of systolic pressure, or a rise of 15 mmHg of diastolic pressure), taken on two occasions after rest, in combination with generalized oedema and/or proteinuria. Hypertensive disorders of pregnancy which includes gestational hypertension, preeclampsia and eclampsia occurs after 20th week of pregnancy.[1,2] Gestational hypertension is characterized by hypertension without proteinuria and oedema. Preeclampsia is characterized by hypertension, proteinuria, and generalized oedema.[3] When preeclampsia progresses and convulsions develop, the condition is termed as eclampsia.[3-5]

Preeclampsia or eclampsia may develop retinal and choroidal circulation dysfunction and various fundoscopic findings and subsequent vision loss may occur as a result. These patients may have severe hypertensive retinopathy findings such as retinal hemorrhage, subretinal serous fluid accumulation, papilledema, and Elschnig spots.[6] Other most common ocular complications that could be associated with (pre)eclampsia are Purtscher like retinopathy, cortical blindness, retinal or vitreous hemorrhages serous retinal detachment, and central retinal vein occlusions. The visual symptoms may include blurred vision, double vision, sudden transient vision loss, flashing lights, and visual field complaints, including homonymous hemianopia.[7]

A dramatic endpoint of vision loss in preeclampsia is cortical blindness.[8] This complication, though uncommon, that happens only in the severe preeclampsia is the sudden decreased vision.[9] However, the loss of vision and serous retinal detachments accompanies the preeclamptic period generally and subsides in the postpartum period.[10] It is thought that the degree of changes in retina of patients with preeclampsia/eclampsia may indirectly correlate with the severity of placental vascular alterations and as a result with insufficiency of placenta and low birth weight of fetus.[11] Some authors believe that all women in childbearing ages should be evaluated of preeclampsia/ eclampsia if they have any retinal or choroidal findings of malignant hypertension.[12]

The aim of the present study was to assess the prevalence of retinal changes in hypertensive disorders of pregnancy and to understand the association between retinal changes and severity of hypertension and proteinuria.

## MATERIALS AND METHODS

The Observational Analytical Cross-Sectional Study was conducted in the Department of Ophthalmology, MGM Medical College and LSK, Kishanganj for the period of 18 Months. 125 cases were included in the study.
Source of Data: Prescription and laboratory reports of pregnant females with new onset of hypertension after 28$^{th}$ week of gestation with proteinuria.

**Ethical Consideration:**

The study protocol was approved by the institutional ethics committee of MGM Medical College and LSK, Kishanganj and complied with International Conference on Harmonization Guideline for Good Clinical Practice and the Declaration of Helsinki. Informed consent was taken from patients. Participant Information Sheet (PIS) was provided and explained to patients in their local language. Thereafter, consent was approved by taking their signature or thumb impression on the informed consent form. The data were obtained from the hospital record system after appropriate approval from the concerned authorities.

**Inclusion criteria:**

- Pregnant females with new onset of hypertension after 28th week of gestation with proteinuria

Exclusion criteria:

- Patients with pre-existing hypertension, diabetes mellitus, renal disease or hazy media which will not permit fundus visualization will be excluded from the study.
- Any other ocular pathology leading to fundus changes.
- Patients not willing to give written informed consent.

Methodology

- Age, gravida, and para of the patients were noted.
- Gestational age was noted.
- Relevant ocular history was extracted from the records.
- Visual acuity was checked using the Snellen's chart, and for patients who could not be shifted, bedside vision was taken with Snellen
- Slit lamp examination of the anterior segment was done, wherever possible with fundus camera.
- Pupils were dilated using tropicamide eye drops, and fundus evaluation was done using an indirect ophthalmoscope.
- Fundus pictures were taken, wherever possible.
- Systemic examination was conducted to rule out other co- morbidities.
- Blood pressure was recorded for all the patients.
- Routine urine analysis was performed to detect the presence of protein and sugar.
- Protein was analyzed using the urine dipstick method.
- Biochemical investigations, including blood urea, serum creatinine, serum uric acid, and total proteins, were conducted and recorded.
- Patients were followed up after delivery and reassessed for the persistence of fundus changes.

Statistical Analysis: Data were analyzed using SPSS version 26.0 for Windows. Descriptive statistics were used to summarize demographic, clinical, and ocular characteristics. Simple statistical methods, including tables and bar diagrams, were used for descriptive data. Data were expressed as frequency and percentage. The prevalence of fundus changes with a 95% confidence interval was calculated. The frequency of different types of fundus abnormalities was compared using

the chi-square test or Fisher's exact test (as appropriate) to evaluate the statistical significance of differences. A p-value of less than 0.05 was considered statistically significant. Additionally, the association between fundus changes and systemic parameters such as blood pressure, proteinuria, and biochemical investigations (blood urea, serum creatinine, serum uric acid, and total proteins) was assessed.

**RESULTS**

Table 1: Baseline characteristics

| Age Group | Number of Patients | % of patients (n= 125) | 95% CI of % |
|---|---|---|---|
| **≤20** | 13 | 10.4% | 5.1% – 15.6% |
| **21-25** | 72 | 57.6% | 48.6% – 66.6% |
| **26-30** | 28 | 22.4% | 14.8% – 30.0% |
| **31-35** | 9 | 7.2% | 2.6% – 11.9% |
| **>35** | 3 | 2.4% | 0.0%-5.0% |
| **Parity** | | | |
| **Primigravida** | 78 | 62.4% | 53.7% – 71.1% |
| **Multigravida** | 47 | 37.6% | 28.9% – 46.3% |
| **Gestational Age in Weeks** | | | |
| **20-24** | 4 | 3.2% | 0.0% – 6.3% |
| **25-28** | 9 | 7.2% | 2.6% – 11.9% |
| **29-32** | 31 | 24.8% | 17.0% – 32.6% |
| **>32** | 81 | 64.8% | 56.4%-73.2% |

The majority of pregnant women with pregnancy-induced hypertension (PIH) were aged 21–25 years (57.6%), followed by 26–30 years (22.4%), suggesting that younger pregnant women are more susceptible to PIH. Only 2.4% were above 35 years, indicating that advanced maternal age is less commonly associated with PIH in this study. Most patients with PIH were primigravida (62.4%), while 37.6% were multigravida, implying that first-time pregnancies carry a higher risk of developing PIH compared to subsequent pregnancies. A significant proportion of PIH cases (64.8%) occurred after 32 weeks of gestation, while only 3.2% presented between 20–24 weeks, indicating that PIH predominantly manifests in the third trimester.

Table 2: Distribution of Patients with PIH with respect to Severity of Hypertension, Grades of Proteinuria and Fundus Findings

| Severity of Hypertension | Number of Patients | % of patients (n= 125) | 95% CI of % |
|---|---|---|---|
| **< 150/100** | 80 | 64 | 55.5-72.5 |
| **≥ 150/100** | 45 | 36 | 27.5-44.5 |
| **Grades of Proteinuria** | | | |
| **1+** | 65 | 52.0% | 43.0% – 61.0% |
| **2+** | 43 | 34.4% | 26.0% – 42.8% |
| **3+** | 17 | 13.6% | 7.5%-19.7% |
| **Fundus Findings** | | | |
| **Normal** | 44 | 35.2% | 26.8% – 43.6% |
| **Hypertensive Retinopathy** | 73 | 58.4% | 49.5% – 67.3% |
| **Central Serous Retinopathy** | 5 | 4.0% | 0.6% – 7.4% |
| **Macular Edema** | 3 | 2.4% | 0.0% – 5.0% |

Most patients (64%) had mild hypertension (<150/100 mmHg), while 36% had severe hypertension (≥150/100 mmHg), highlighting that a considerable proportion of PIH cases progress to severe hypertension. Over half of the patients (52%) had mild proteinuria (1+), while 34.4% had moderate (2+) and 13.6% had severe proteinuria (3+), suggesting that proteinuria severity varies widely in PIH. Hypertensive retinopathy (58.4%) was the most common ocular finding, followed by normal fundus (35.2%), while central serous retinopathy (4%) and macular edema (2.4%) were rare, indicating that retinal changes are frequent in PIH.

Table 3: Distribution of Patients with PIH with respect to Grade of Hypertensive Retinopathy

| Grade | Number of Patients | % of patients (n= 125) | 95% CI of % |
|---|---|---|---|
| **No HR** | 52 | 41.60% | 33.34-50.36 |
| **Grade I** | 66 | 52.80% | 44.10-61.34 |
| **Grade II** | 7 | 5.60% | 2.74-11.11 |
| **Grade III** | 0 | 0% | 0% - 2.98% |
| **Grade IV** | 0 | 0% | 0% - 2.98% |

Grade I retinopathy (52.8%) was most common, followed by no retinopathy (41.6%), while Grade II (5.6%) was less frequent, and Grades III & IV were absent, suggesting that severe retinopathy is uncommon in PIH.

Table 4: Association of Retinopathy with Severity of Hypertension, with Severity of Grade of Proteinuria

| Blood Pressure | No HR *n*=52 | Gr 1 (n =66) | Gr 2 (n =7) | Total | P-Value (Fisher's Exact Test) |
|---|---|---|---|---|---|
| **< 150/100** | 46 (57.5 %) | 34 (42.5%) | 0 | 80 (100%) | <0.0001 (No HR vs Gr 1-2) |
| **≥ 150/100** | 6 (13.3%) | 32 (71.1%) | 7 (15.6%) | 45 (100%) | |
| Proteinuria | | | | | |
| **1+** | 36 (55.4 %) | 27 (41.5%) | 2 (3.1) | 65 (100%) | 0.0082 (No HR vs Gr 1-2; 1+ vs 2+ & 3+)) |
| **2+** | 16 (37.2%) | 24 (55.8%) | 3 (7.0%) | 43 (100%) | |
| **3+** | 0 | 14 (82.4%) | 3 (17.6%) | 17 (100%) | |

Patients with severe hypertension (≥150/100 mmHg) had significantly higher rates of retinopathy (Gr 1 & 2: 86.7%) compared to those with mild hypertension (42.5%) ($p < 0.0001$), indicating a strong link between BP severity and retinopathy. Higher grades of proteinuria (2+ and 3+) were significantly associated with retinopathy ($p = 0.0082$), with 82.4% of 3+ proteinuria cases having retinopathy, suggesting that proteinuria severity correlates with retinal changes.

Table 5: Association of Retinopathy with Age

| Age Group | No HR *n*=52 | Gr 1 (n =66) | Gr 2 (n=7) | Total | P-Value (Fisher's Exact Test) |
|---|---|---|---|---|---|
| **≤20** | 1 (7.7%) | 10 (76.9%) | 2 (15.4%) | 13 | 0.0142 (No HR vs Gr 1-2; ≤30 vs >30) |
| **21-25** | 38 (52.8%) | 34 (47.2%) | 0 (0%) | 72 | |
| **26-30** | 12 (42.9%) | 16 (57.1%) | 0 (0%) | 28 | |
| **31-35** | 1 (11.1%) | 5 (55.6%) | 3 (33.3%) | 9 | |
| **>35** | 0 (0%) | 1 (33.3%) | 2 (66.7%) | 3 | |

Younger women (≤20 years) and older women (>30 years) had higher retinopathy rates ($p = 0.0142$) compared to those aged 21– 30 years, indicating that extremes of maternal age increase retinopathy risk.

Table 6: Association of Retinopathy with Parity

| Parity | No HR *n*=52 | Gr 1 (n =66) | Gr 2 (n =7) | Total | P-Value (Fisher's Exact Test) |
|---|---|---|---|---|---|
| Primigravida | 42 (53.8%) | 36 (46.2%) | 0 (0%) | 78 | 0.0004 (No HR vs Gr 1-2) |

| | | | | | |
|---|---|---|---|---|---|
| Multigravida | 10 (21.3%) | 30 (63.8%) | 7 (14.9%) | 47 | |

Multigravida women had significantly higher retinopathy rates (78.7% in Gr 1 & 2) compared to primigravida (46.2%) ($p = 0.0004$), suggesting that multiparity may worsen retinal involvement in PIH.

**DISCUSSION**

Pregnancy-induced hypertension (PIH), including conditions like preeclampsia, is a complex multisystem disorder that typically manifests after the 20th week of gestation. It is characterized by new-onset hypertension, often accompanied by proteinuria, and poses significant risks to both maternal and fetal health. The underlying pathophysiology involves endothelial dysfunction, systemic vasoconstriction, and placental ischemia, which can lead to widespread vascular damage.[13] Among the affected organs, the retina is particularly vulnerable due to its highly sensitive vasculature. Hypertensive retinopathy in PIH results from elevated blood pressure causing arteriolar narrowing, sclerosis, and, in severe cases, retinal hemorrhages, exudates, or even detachment. These retinal changes serve as a visible indicator of systemic vascular involvement, making fundus examination a valuable non-invasive tool for assessing disease severity.[14] The majority of cases occurred in women aged 21–25 (57.6%), suggesting that younger pregnant women are more susceptible to PIH. However, extremes of maternal age—women under 20 or over 30—demonstrated a higher prevalence of retinopathy, indicating that both immature vasculature in younger mothers and age- related endothelial dysfunction in older women may exacerbate retinal involvement.[15]

Additionally, multigravida women had significantly higher rates of retinopathy (78.7%) compared to primigravidas (46.2%), implying that repeated pregnancies may contribute to cumulative vascular stress, increasing the likelihood of retinal damage.[16] A key finding was the strong association between the severity of hypertension and retinopathy. Patients with severe hypertension (≥150/100 mmHg) exhibited significantly higher rates of retinopathy (86.7%) compared to those with milder hypertension (42.5%). This underscores the importance of aggressive blood pressure control in mitigating end-organ damage, including retinal changes. Similarly, the severity of proteinuria correlated with retinopathy, with 82.4% of women experiencing 3+ proteinuria showing retinal abnormalities. This reinforces the role of proteinuria as a marker of systemic endothelial dysfunction and a predictor of ocular complications.[17]

The study also highlighted the timing of PIH onset, with the majority of cases (64.8%) occurring after 32 weeks of gestation, consistent with the typical third-trimester presentation of placental dysfunction. Early-onset PIH (20–24 weeks) was rare but may warrant closer monitoring due to its association with higher morbidity. Fundus findings revealed that hypertensive retinopathy (58.4%) was the most common ocular abnormality, primarily Grade I (52.8%), indicating early vascular changes. The absence of advanced retinopathy (Grades III/IV) suggests that severe retinal damage is uncommon in PIH, but even mild changes should not be overlooked, as they reflect systemic vascular compromise. Rare conditions like central serous retinopathy (4%) and macular edema (2.4%) were also noted, emphasizing the need for ophthalmologic evaluation in high-risk cases to prevent vision-threatening complications. The study's results have significant implications for clinical practice. First, fundus examination should be integrated into routine prenatal care for women with PIH, particularly those with severe hypertension, multigravidity, or extremes of maternal age. Early detection of retinopathy can serve as a warning sign for systemic vascular involvement, prompting timely intervention. Second, risk stratification based on proteinuria and blood pressure levels can help identify women at higher risk for complications, enabling targeted monitoring and management. For instance, patients with proteinuria ≥2+ or blood pressure ≥150/100 mmHg should undergo more frequent evaluations to detect and address end-organ damage promptly.

Our study found hypertensive retinopathy in 58.4% of cases, which aligns closely with Reddy et al[18] (2012, 59%) and Raja & Seema[19] (2025, 54%), but contrasts sharply with Bharathi et al[20] (2015, 23.33%) and Shah et al[21] (2015, 12%). This variation likely reflects differences in study populations, with our study and Reddy's focusing on hospitalized patients with likely more severe PIH, while Bharathi and Shah may have included milder cases. The higher prevalence in our study could also indicate improved diagnostic sensitivity or regional differences in disease severity. Notably, Varija et al[22] (2016) reported 42.7% prevalence but found dramatically higher rates (76.5-100%) in imminent eclampsia and eclampsia subgroups, supporting the concept that retinopathy prevalence directly correlates with disease severity. The distribution of retinopathy grades shows interesting patterns across studies. Our finding of 52.8% Grade I and 5.6% Grade II (with no Grades III-IV) closely matches Reddy et al.'s[18] distribution (52.6% Grade I, 6.4% Grade II). However, Bharathi et al[20] reported Grade III (3.9%) and Grade IV (1.3%) cases, while Raja & Seema found 6% Grade III and 2% Grade IV.[19] This discrepancy may reflect differences in disease severity at presentation or varying diagnostic criteria. The complete absence of advanced retinopathy in our study and Reddy's suggests that contemporary management may be preventing progression to severe retinal changes in many cases.

All studies consistently demonstrated strong associations between retinopathy and hypertension severity. Our finding that 86.7% of severe hypertension (≥150/100 mmHg) cases had retinopathy aligns with Bakhda et al.'s[23] (2016) report of 98.68% fundus changes in severe preeclampsia 126]. Our finding of higher retinopathy rates at maternal age extremes (≤20

and >30 years) contrasts with Shah et al.'s[21] (2015) non- significant age association (p=0.865), possibly reflecting differences in population characteristics or sample sizes. The strong parity association we observed (78.7% retinopathy in multigravidas vs 46.2% in primigravidas) wasn't replicated in Shah et al.'s gravida analysis (p=0.07), suggesting this relationship may depend on specific population characteristics or require larger samples to detect.

While prevalence rates vary, all studies converge on the clinical importance of retinopathy assessment in PIH. Our findings generally align with contemporary research while providing additional insights into demographic risk factors. The collective evidence strongly supports integrating fundus examination into PIH management protocols to assess severity, predict complications, and guide clinical decisions. Future research should standardize examination protocols and explore longitudinal relationships between retinal changes and long-term maternal cardiovascular outcomes.

## CONCLUSION

Our study sheds light on the prevalence and impact of hypertensive disorders in pregnancy, emphasizing significant associations between retinal changes and factors such as blood pressure severity, proteinuria, maternal age, and parity. The findings highlight that younger and older maternal ages, primigravida status, advanced gestational age, severe hypertension, and higher grades of proteinuria are key risk factors for retinal involvement. While hypertensive retinopathy was the most common ocular finding, severe retinopathy grades were rare. These results underscore the importance of early detection and monitoring of retinal changes in managing hypertensive disorders of pregnancy to improve maternal and fetal outcomes.

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