

Visual morbidity and spectrum of ophthalmic changes in pregnancy induced hypertension

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ABSTRACT

Aim: To determine the prevalence of ocular changes in pregnancy-induced hypertension (PIH) and co-relate the ophthalmic changes and severity of the disease with visual outcome. **Methods and Material:** This is a retrospective study conducted from a hospital-based cohort of pregnant women, who delivered from June 2018 to December 2020. A total of 153 patients who fulfilled the diagnostic criteria of PIH admitted in the obstetric ward were included in this study. History with regard to age, parity, gravida, gestational age, medical history, and ocular findings were noted from the patient's case records. Anterior segment examination, dilated fundus evaluation, blood pressure (BP) recordings, urine proteinuria were done. All data were analyzed using the statistical package for social science (SPSS) program. **Results:** Out of 153 patients, 78 (50.98%) were primigravida, 55 (35.95%) were gravida 2, and 20 (13.07%) were multigravida. Gestational age ranged from 23–40 weeks. Ocular changes were seen in 57% of the PIH patients. Hypertensive retinopathy was seen in 23.53% of PIH patients with a mean age of 29.06 ± 4.36 years. Grade 1 hypertensive retinopathy was the most common manifestation in PIH patients (51.16%). The visual loss occurred in 72% of eclampsia and 12% of pre-eclampsia which was statistically significant ($P = 0.03$). Papilledema was seen in 6% and refractive error in 41% of the patients. **Conclusions:** Ocular examination of PIH patients reveals important objective information concerning the disorder. The presence of retinal change is a marker of the severity of PIH and is the most common ocular feature. Detection of progression of these changes reflects ischemic changes of the placenta. Fundus examination in PIH patients is important to predict adverse fetal outcomes, and risks to mother's life.

Keywords: Eclampsia, exudative retinal detachment, hypertensive retinopathy, pre-eclampsia, pregnancy-induced hypertension

Introduction

Pregnancy-induced hypertension (PIH) includes gestational hypertension, pre-eclampsia, and eclampsia. PIH is a hypertensive 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 edema and/or proteinuria.^[1] It is one of the most common complications that occurs in pregnancy and contributes

to significant ocular morbidity. When PIH is associated with proteinuria, it is preeclampsia; seizures as a consequence of PIH is eclampsia.^[2] PIH is a common obstetrical complication that leads to new-onset hypertension and damage to other organs after 20 weeks of gestation.^[3] Ocular involvement is common in PIH occurring in 30%–60% of patients. Subjective visual symptoms including decreased vision, visual field defects, diplopia, photopsia are present in approximately 40% of PIH patients.^[4] Vasospastic manifestations are reversible and the retinal vessels rapidly return to normal after delivery.^[5] Thus, immediate identification of progressive retinopathy has significance both in the prognosis of pregnancy and vision. Fundus examination helps in diagnosing the disease and also assists in assessing the severity, progression, response to treatment, and ultimate outcome. The aim of this study was to identify the ocular manifestations of PIH in a tertiary

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care hospital and to study its effect on vision. Although there are several reports of eye involvement in PIH, to our knowledge this is the first study that correlates visual loss with the type of ocular involvement in PIH.

Subjects and Methods

We retrospectively reviewed the medical records from a hospital-based cohort of pregnant women, who delivered in our Hospital from June 2018 to December 2020. A total of 153 patients who fulfilled the diagnostic criteria of PIH admitted in the obstetric ward in our hospital were included in this study. Patients with pre-existing vascular/renal disease, any underlying ocular comorbidity like glaucoma, cataract, or pre-existing retinopathy, and cases with placental abnormalities and congenital anomalies in the fetus were excluded from the study.

After obtaining history for any eye symptoms, extraocular movements and the anterior segment were examined. Both pupils were dilated with 1% tropicamide eye drops, and the fundus examination was done by the ophthalmologist with a direct ophthalmoscope in the ward. Changes suggestive of hypertensive retinopathy were taken as positive findings in these patients. Age, parity, gravida, gestational age, medical history, and blood pressure recordings were noted from the case records.

PIH was graded as gestational hypertension, preeclampsia, and eclampsia.

Gestational hypertension is defined as a systolic blood pressure 140 mm Hg or more or a diastolic blood pressure of 90 mm Hg or more, or both, on two occasions at least 4 h apart after 20 weeks of gestation, in a woman with previously normal blood pressure.

Based on American College of obstetricians and Gynaecologist (ACOG) 2020 guidelines, we adopted the following criteria while recruiting patients into our study.^[6] Pre-eclampsia is defined as new-onset hypertension and proteinuria after 20 weeks of gestation.

1. Systolic blood pressure of 140 mm Hg or more or diastolic blood pressure of 90 mm Hg or more on two occasions at least 4 h apart after 20 weeks of gestation in a woman with previously normal blood pressure.
2. Proteinuria 300 mg or more per 24 h urine collection (or this amount extrapolated from a timed collection) or protein/creatinine ratio of 0.3 mg/dL or more, or Dipstick reading of 2+ (used only if other quantitative methods not available).
3. In the absence of proteinuria, new-onset hypertension with the new onset of any of the following: Thrombocytopenia, renal insufficiency (serum creatinine >1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease), impaired liver functions, pulmonary edema, and new-onset headache unresponsive to medication and not accounted for by alternative diagnoses or visual symptoms.

Eclampsia is defined as the development of generalized tonic-clonic seizures not due to another cause in a woman with pre-eclampsia.

The retinal changes (hypertensive retinopathy) were graded according to Keith Wagener classification into^[7]:

Grade 1: Mild generalized arterial attenuation;

Grade 2: More severe Grade 1 with focal arteriolar attenuation;

Grade 3: Grade 2 changes plus hemorrhages, hard exudates, cotton wool spots;

Grade 4: Grade 3 changes with optic disc swelling (papilledema).

Statistical analysis

The results were analyzed using SPSS software. For descriptive statistics, percentage, mean, and standard deviations were used. For inferential statistics, Chi-square and independent *t*-test were used to find the association and difference in mean, respectively. $P < 0.05$ was taken as statistically significant.

Results

Out of 153 patients, 78 (50.98%) patients were primigravida, 55 (35.95%) were gravida 2, and 20 (13.07%) were multigravida. Age distribution of the study population ranged from 21 to 45 years [Table 1]. Gestational age ranged from 23 to 40 weeks. Among the study cohort of 153, 81 (52.95%) patients had gestational hypertension, 42 (27.45%) patients had preeclampsia, 12 (7.8%) patients developed eclampsia, and the remaining 18 (11.76%) had an associated history of chronic hypertension [Table 2].

Patients with PIH also had associated medical conditions such as diabetes in 25 (16%), hypothyroidism in 14 (9%), idiopathic intracranial hypertension (IIH) in 5 (3%), systemic lupus erythematosus (SLE) in 2 (1.3%), rheumatoid arthritis in 1 (0.6%), *rheumatic heart disease* (RHD) in 1 (0.6%), and Turner's syndrome in 1 (0.6%).

Ocular changes in patients with PIH were seen in 57%. Out of 153, 93 (58.82%) patients had normal fundus, 43 (23.53%)

Table 1: Grade of gravida

Gravida	Number of patients	Percentage
Primigravida	78	50.98%
Gravida 2	55	35.95%
Multigravida	20	13.07%
Total	153	100%

Table 2: Distribution of PIH

PIH Distribution	Number of patients	Percentage
Gestational hypertension (GH)	81	52.95%
Pre-eclampsia	42	27.45%
Eclampsia	12	7.8%
Pre-existing hypertension with exaggeration	18	11.76%
Total	153	100%

had some grade of hypertensive retinopathy in either eye, and remaining 17 (15.69%) patients presented with other nonspecific ocular changes. In the present study, hypertensive retinopathy was seen in 23.53% of the patients with PIH, and the mean age of subjects was 29.06 ± 4.36 years.

Among 43 patients with hypertensive retinopathy, Grade 1 retinopathy was seen in 22 (51.16%), Grade 2 hypertensive retinopathy in 7 (16.28%), Grade 3 hypertensive retinopathy in 4 (9.3%) patients, and grade 4 hypertensive changes were seen in 10 (23.26%) patients. Out of 10 patients with Grade 4 hypertensive retinopathy, 1 patient with a history of Turner's syndrome had developed bilateral exudative retinal detachment [Table 3]. Among 43 patients with hypertensive retinopathy, grade 1 changes with arteriolar attenuation were the most common presentation.

Proteinuria was present in 12 patients (7.8%). We however did not find any association with ocular involvement but it reflected severe pre-eclampsia [Figure 4].

Changes in retinal vasculature such as arterial attenuation and arteriovenous (AV) crossing changes were more common in preeclampsia [Figure 1], whereas optic nerve head and visual

pathway changes were common in eclampsia. This visual loss was due to refractive error in 41%, fundus changes in 51%, and neuro-ophthalmic changes in 8%. The visual loss occurred in 72% of eclampsia and 12% of pre-eclampsia which was statistically significant with $P = 0.03$. In our study, papilledema was seen in 6% of the cases [Figure 2]. Cortical blindness with transient visual impairment was recovered in 48 h after control of hypertension, and delivery occurred in 3 (1.9%) patients. The neurological evaluation showed ischemic changes in the occipital cortex.

The most common refractive error was myopia in 18%. Hypermetropia occurred in 12% and astigmatism in 11% [Table 4]. Refractive errors occurred most commonly during the third trimester. This can be explained by the myopic shift that occurs due to fluid accumulation in the cornea and lens as part of water retention in these patients. Myopic fundus was seen in four (2.6%), rate of perceived exertion (RPE) atrophic changes were seen in four (2.6%), macular scar was seen in one (0.6%), old choroiditis was seen in two (1.3%), and LMN lower motor neuron (facial palsy) was seen in one (0.6%).

Discussion

Changes in the retinal vascularity reflect the status of hypertension, and fundus examination has been considered

Table 3: Fundus changes and grade of hypertensive retinopathy

Hypertensive Retinopathy	Number of patients	Percentage
Grade 1	27	51.16%
Grade 2	4	16.28%
Grade 3	7	9.3%
Grade 4	10	23.26%
Exudative RD	1	2.36%

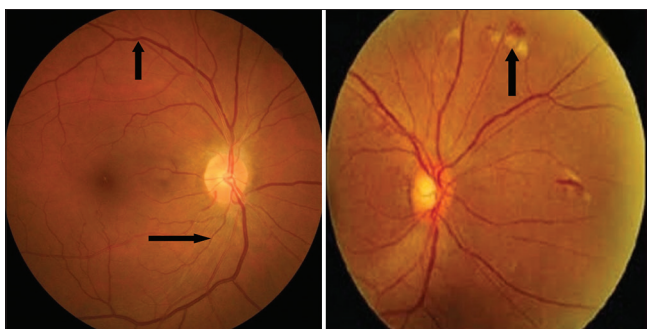


Figure 1: Right eye grade 2 hypertensive retinopathy (white arrow - arteriolar attenuation, black arrow - AV crossing changes). Left eye grade 3 hypertensive retinopathy (Black arrow - cotton wool spots)



Figure 3: Bilateral exudative retinal detachment

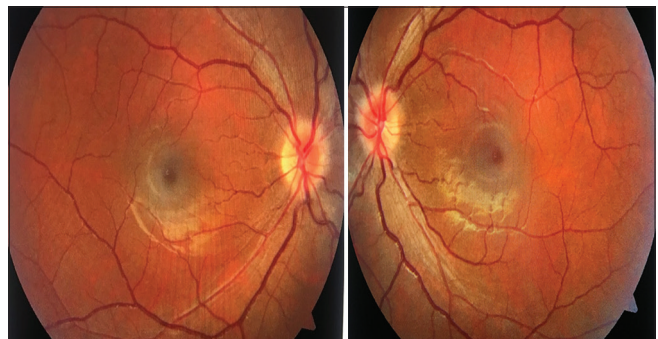


Figure 2: Both eyes papilledema

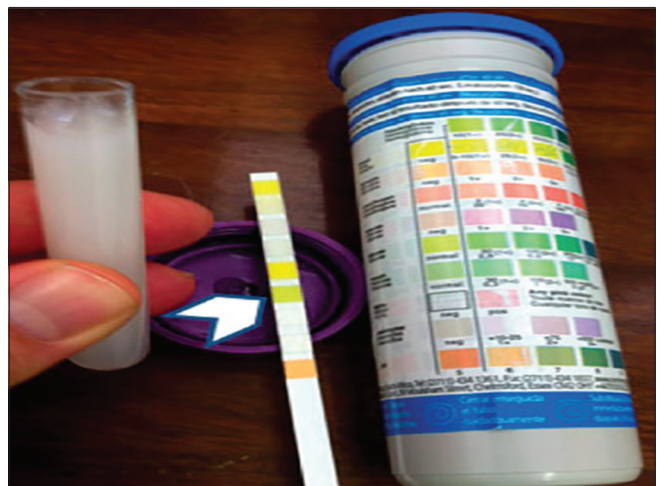


Figure 4: Urine protein analysis

Table 4: Causes of visual loss IN PIH

Causes of visual loss	Number of patients	Percentage
Visual Loss in Retinal Changes		
Arteriolar attenuation	27	51%
AV crossing changes	4	16%
Exudative RD	1	2%
Optic nerve head changes	10	23%
Pathological Myopia	4	16%
LMN facial palsy	1	2%
Visual Loss due to Refractive errors		
Myopia	27	18%
Hypermetropia	18	12%
Astigmatism	16	11%

as a routine practice to assess the progression of systemic hypertension. In PIH, retinal evaluation is done to assess maternal hypertension and fetal health. An ophthalmologist plays an important role in the management of these patients as advanced retinal changes will require drastic decisions such as termination of pregnancy. This may have to be planned particularly if exudative retinal detachment or papilledema is detected during the ophthalmic examination as it indicates similar changes as a cause of placental ischemia.^[8] The aim of our study was to analyze the fundus changes in pre-eclampsia and eclampsia and its effect on visual loss. In the present study, 78 (50.98%) were primigravidae, and 20 (13.07%) were multigravida. In an Indian study, Nandha *et al.*^[9] discovered that 67% of PIH cases were primigravidas.

Tadin *et al.*^[10] in their retrospective study of 40 women with pre-eclampsia, 45% (18 cases) showed retinal changes their average age being 29.1 ± 7.4 years. Karki *et al.*^[11] from Nepal have reported 13.7% of fundus changes in their study of 153 subjects with PIH. Reddy *et al.*^[12] from Malaysia found a prevalence rate of 59% in their study of 78 cases with PIH.

According to Duke Elder, the most common retinal change is attenuation of retinal arterioles, occurring in approximately 60% of patients with pre-eclampsia.^[13] A similar result was also seen in the present study in which grade 1 hypertensive retinopathy was the most common manifestation in PIH patients.

Rasdi *et al.*^[14] in their study of 50 patients found grade I hypertensive retinopathy in 24 patients (48.0%), grade II changes in 21 patients (42.0%), grade III retinopathy in 4 patients (8.0%), and grade IV hypertensive retinopathy in 1 patient. The findings in our study were in consonance with other studies conducted. Shah *et al.*^[15] 21 reported that “hypertensive retinopathy” was among 12% cases, followed by Grade I in 8% and Grade II in 4%, whereas hemorrhages or exudates or retinal detachment was not found in any case.

In our study, we found that the changes correlated with previous observations, but we noted a significant difference in the age groups affected. Although previous literature and studies stated that it is most common in the pregnancy above 4th decade, we

found that retinopathy was of equal occurrence and frequency among pregnant women in their third and fourth decades of life. This occurs probably because of rigid arteries in younger age groups which can result in more severe retinopathy when younger individuals are affected.^[16]

Other infrequent features that were observed were retinal edema, hemorrhages, cotton wool spots and papilledema, and neurosensory detachments. The rare occurrence of severe complications that adversely affect vision was likely due to earlier detection and treatment thus preventing further vascular changes. Jaffe and Schatz have reported the absence of hemorrhages, exudates, cotton wool spots, or retinal detachment in their study of 17 mild preeclamptic and 14 severe preeclamptic patients.^[17]

Tadin *et al.*^[10] in their study observed a statistically significant association between the grades of hypertensive retinopathy and severity of pre-eclampsia ($P = 0.033$). Reddy *et al.*^[12] found that degree of retinopathy was directly proportional to the severity of preeclampsia.

The visual loss occurred more frequently in eclampsia than in pre-eclampsia patients. Almost all patients had complete visual recovery after childbirth when the hypertension was reversed. The anatomical changes in the fundus were noted in 1 month in the majority of patients. Other causes of visual loss during PIH were corneal edema and change in refractive errors. Karki *et al.* reported no significant visual disturbances and most of the patients had visual acuity between 6/6 and 6/9.^[11] Bharathi *et al.*^[18] in their study noted blurring of vision in eight (5.3%) cases and sudden loss of vision in two cases (1.3%).

The presence of papilledema in the eyes may indicate raised intracranial tension, and such patients may develop convulsions. Exudative retinal detachments and papilledema occurred only in eclampsia. Predominant changes in preeclampsia were arterial attenuation and arterio-venous crossing changes. However, with the current methods of early diagnosis and treatment, the incidence of such severe retinopathy changes has come down. The incidence of serous retinal detachment was reported as an uncommon manifestation in early PIH by Rasdi *et al.*^[14] reported a case of serous retinal detachment from Malaysia.

Bilateral exudative retinal detachment is seen rarely in PIH patients [Figure 3]. It is thought to be caused by choroidal ischemia.^[19] Retinal pigment epithelial lesions, called Elschnig spots, may also be found in pre-eclamptic patient with choroidal infarcts.^[20] The prognosis in these cases is good, with visual symptoms and retinal pigment epithelial changes resolve spontaneously within weeks of delivery. The presence of macular edema or papilledema or retinal detachment are the warning signs for termination of pregnancy. The management of retinal detachment is not surgery, but termination of pregnancy after controlling blood pressure so that vision can be saved in the affected eye.

This study will help an understanding of the involvement of the eye in patients with PIH and the importance of timely referral to an ophthalmologist. It will also provide an insight into the various types of ocular manifestations that can occur in these patients.

Through our study, we hope to emphasize that visual loss and sight-threatening complications can occur in eclampsia and preeclampsia. Thus, we recommend that an opinion from an ophthalmologist needs to be a part of routine practice while treating these patients.

Conclusion

In conclusion, definite retinal changes are present in PIH, but visual symptoms are fewer in patients with PIH, and often absent unless the macula is involved. Sudden onset of headache and visual loss which is resistant to routine therapy may be the warning symptom before the onset of the first convulsion. Attenuation of arterioles is the first detectable and most common retinal change. The majority of retinal changes were Grade I hypertensive retinopathy. Progress of retinopathy increases with the severity of PIH and usually regresses with a decrease in blood pressure and may disappear completely after delivery due to lack of placental toxins. Regular ocular examination reveals important objective information concerning this disorder with regard to severity and is of prognostic value. We recommend a liaison between the ophthalmologist and obstetrician to ensure safe delivery in these patients.

Key messages

PIH can cause significant ocular morbidity. We found that retinopathy is common in the third decade because of rigid arteries in younger age groups. Visual loss is more frequent in eclampsia than in pre-eclampsia patients. Retinopathy occurred within 1 month, and complete visual recovery was seen after childbirth.

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Conflicts of interest

There are no conflicts of interest.

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