



INTRAOCULAR PRESSURE, FUNDUS CHANGES AND BLOOD PRESSURE CORRELATION IN PREGNANCY INDUCED HYPERTENSION

Ophthalmology

Dr. S. H. Shegaonkar*

Professor and Head, Department of Ophthalmology, Government Medical College, Miraj, Maharashtra, India. *Corresponding Author

Dr. Vrinda M. Dalwani

Junior Resident III, Department of Ophthalmology, Government Medical College, Miraj, Maharashtra, India.

ABSTRACT

AIM: The aim was to determine the variation in intraocular pressure in pre and post delivery period and its correlation with blood pressure along with prevalence of retinal changes in PIH and association between the retinal changes and age, parity, blood pressure and severity of the disease.

Material and methods: All the patients admitted with a diagnosis of PIH were included in this study. Age, gravida, gestation period, blood pressure was noted from the case records. The intraocular pressure was taken in the pre and post delivery period using a Schiotz tonometer under topical anaesthesia. Fundus examination was done with a direct ophthalmoscope. The findings were noted and were analyzed using SPSS program.

Result: A total of 225 patients of PIH were examined. A significant positive association of retinal changes and blood pressure ($P < 0.001$), proteinuria ($P < 0.039$) and severity of PIH was found ($p = 0.001$). There was no association of age, parity and gestational age of patient with fundus finding ($p > 0.05$). A decrease in IOP of 6.76% in right eye and 10.66% in left eye is found. Blood Pressure and IOP are negatively correlated in this study in the pre and post delivery. This is statistically significant.

KEYWORDS

PIH, Intraocular pressure, Hypertensive Retinopathy

INTRODUCTION

Hypertension is one of the most common complications of pregnancy contributing significantly to maternal and perinatal morbidity and mortality worldwide.^[1]

There are studies on PIH but with little mention of changes of intraocular pressure (IOP) during and after pregnancy of these patients. This paucity of data has led us to study physiological variation of IOP in women with preeclampsia and eclampsia and their correlation with raised blood pressure. Therefore, this study was undertaken to determine the prevalence of ocular variations in PIH and association between BP and IOP, the retinal changes and other variables. This study mainly investigates whether the high BP found in late pregnancy does or does not influence the known ocular hypotensive effect of late pregnancy.

Objectives:

- To study IOP variation in pre and post delivery period of patients of PIH.
- To study the frequency of fundus changes in PIH.
- Their correlation with raised BP.

Materials and Methods

This was a cross-sectional study done on patients diagnosed with PIH and admitted in the ANC ward, Government Medical College, Miraj over a period of 18 months (January 2018 till May 2019) and consenting for the study. Examination included age, sex, gestation period, gravida. Brachial BP measurements were taken after a complete rest of 15 minutes in supine posture with a manual mercury sphygmomanometer. Complete ophthalmic history was taken. Visual acuity was measured using Snellen's Chart and for those who couldn't be shifted, bed side vision testing was done. External Examination was done under torch light following which the eyes were anaesthetized with 0.5% Proparacaine. IOP was measured using Schiotz Tonometer. Three consecutive readings of each eye were taken and the mean recorded. It was measured between 11:00 AM to 6:00 PM to avoid the effect of diurnal variation. The pupils were dilated using Tropicamide + Phenylephrine drops. Posterior segment was examined by ophthalmoscopy (direct and indirect). Hypertensive retinopathy changes seen in both eyes is taken as positive finding in that patient (Grading on Keith Wagener Barker Classification). Routine urine analysis for protein and sugar was done. The IOP was taken again in the immediate postpartum period. BP was recorded similarly as it was done in pre-delivery period. Patients were followed up after delivery and reassessed for persistence of fundus changes. Statistical analysis was performed using SPSS software. Chi square and two-tailed paired student t-test was used for statistical analysis; $p < 0.05$ is considered significant. Pearson's correlation was used to examine the

relationships between IOP and BP.

Inclusion criteria:

- All patients diagnosed with PIH during the study period in OBGY ward.

Exclusion criteria:

- Having comorbid conditions, diagnosed and under treatment of ocular pathology, undergone previous ocular surgery.

RESULTS

A total of 225 patients of PIH were examined.

The mean age of patients was 23.29 ± 3.47 years without retinal changes and 23.56 ± 4.00 years with retinal changes. 187 (83.11%) were primigravida and 38 (16.89%) were multigravida. 1 (0.4%) patient was less than 24 weeks of gestation, 69 (30.66%) were 24-36 weeks and 155 (68.89%) were > 36 weeks gestation. 160 (71.11%) patients had mild preeclampsia, 49 (21.77%) had severe preeclampsia and 16 (7.11%) had eclampsia. The frequency of normal fundus was 85 (37.78%), 132 (58.67%) had hypertensive retinopathy, 3 (2.67%) had retinal detachment and 2 (0.89%) had central serous retinopathy. [Table-1]

59.09% (78 out of 132) patients had Grade-1 Hypertensive Retinopathy, 28.03% (37 out of 132) had Grade-2 and 12.87% (17 out of 132) had Grade-3 [Figure-2]. None of the patients had grade 4 changes. 88.5% showed arteriolar attenuation. Arteriovenous crossing changes were the 2nd most common fundus finding observed (38.5%, 54 out of 132). The next was superficial hemorrhages (9.2%, 13 out of 132). Six cases of exudative retinal detachment were found [Figure 1]. Macular oedema was seen in 2 (1.4%) patients, cotton wool spots in 7 (5%) patients and hard exudates in 3 (2.14%). There was statistically significant positive association of retinal changes and systolic and diastolic BP ($P < 0.00$), proteinuria ($P = 0.039$) and severity of the PIH ($P = 0.001$). Age ($P = 0.109$) and gravida ($P = 0.348$) were not associated with retinopathy changes. [Table-2]

Table-1: Distribution of cases according to different variable

Variable	Number of patients (n=225) (%)
Age (years)	
<20	22 (9.78)
20-24	124 (55.11)
25-29	64 (28.44)
30-34	10 (4.44)
35-40	5 (2.22)

Gravida	
Primigravida	187(83.11)
Multigravida	38(16.89)
Gestational Age(Weeks)	
<24	1(0.4)
24-36	69(30.66)
>36	155(68.89)
Severity of PIH	
Mild Preeclampsia	160(71.11)
Severe Preeclampsia	49(21.77)
Eclampsia	16(7.11)
Fundus Finding	
Normal	85(37.78)
Exudative Retinal Detachment	6(2.67)
Central Serous Retinopathy	2(0.89)
Hypertensive Retinopathy	132(58.67)
• Grade-1	• 78(59.09)
• Grade-2	• 37(28.03)
• Grade-3	• 17(12.87)
• Grade-4	• 0(0)
Individual Fundus Finding	
Arteriolar Attenuation	124(88.5)
AV changes	54(38.5)
Superficial Haemorrhages	13(9.2)
RD	6(4.2)
Macular Oedema	2(1.4)
Cotton wool spots	7(5)
Hard exudates	3(2.14)

Table-2: Association between different variables and fundus findings

Variable	No. of cases with normal Fundus(%)	No. of cases with fundus findings(%)	Total (n=225)	p
Age(years)				
<20	4(18.18)	18(81.82)	22	0.109
20-24	54(43.54)	70(56.46)	124	
25-29	21(32.81)	43(67.19)	64	
30-34	5(50)	5(50)	10	
35-40	1(20)	4(80)	5	
Gravida				
Primigravida	72(38.5)	115(61.5)	187	0.348
Multigravida	13(34.21)	25(65.79)	38	
Severity				
Mild	74(46.25)	86(53.75)	160	0.001
Severe	9(18.36)	40(81.64)	49	
Eclampsia	2(12.5)	14(87.5)	16	
Proteinuria				
+	46(45.5)	55(54.5)	101	0.039
++	28(35.89)	50(64.11)	78	
+++	11(23.91)	35(76.09)	46	
Systolic Blood Pressure				
140-159	74(46.54)	85(53.46)	159	<0.001
160-179	9(18)	41(82)	50	
180-200	2(12.5)	14(87.5)	16	
Diastolic Blood Pressure				
90-99	34(37.78)	56(62.22)	90	<0.001
100-109	41(55.41)	33(44.59)	74	
110-119	8(14.81)	46(85.19)	54	
120-129	2(50)	2(50)	4	
130-140	0	3(100)	3	

++ = 30 mg/dL, ++ = 100 mg/dL, +++ = 300 mg/dL, PIH: Pregnancy-induced hypertension

Table-3: IOP variation

RIGHT EYE	Mean IOP	Standard Deviation	p
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LEFT EYE	Pre-delivery	14.7951	1.85174	0.01
	Post-delivery	13.2000	1.62000	0.01
	Pre-delivery	14.6400	1.76220	0.01
	Post-delivery	13.0818	1.57522	0.01

Table 4: Correlations

	PRES	PREDI	PREIOPR	PREIOPL
PRES	Pearson Correlation		.695**	-.130
	P-VALUE		.001	.052
PREDI	Pearson Correlation			-.105
	P-VALUE			.117
PREIOPR	Pearson Correlation			.846**
	P-VALUE			.001
POSIOPR	Pearson Correlation		.206**	-.104
	P-VALUE		.002	.121
POSIOPL	Pearson Correlation		1	-.191**
	P-VALUE			.004
POSSP	Pearson Correlation			1
	P-VALUE			.713**

** . Correlation is significant at the 0.01 level (2-tailed).

PRES:Pre-delivery systolic Systolic BP, PREDI: Pre-delivery diastolic BP, PREIOPR:Pre-delivery IOP in Left eye. PREIOPR: Pre-delivery IOP in Right Eye, POSIOPR:postdelivery IOP in Right Eye, POSIOPL:Postdelivery IOP in Left Eye, POSSP: Postdelivery Systolic BP, POSDI:Postdelivery Diastolic BP

The mean IOP in pre-delivery period in right eye was 14.79±1.85mmHg and in left eye 14.64±1.76mmHg. The mean IOP in post-delivery period in right eye was 13.2±1.62mmHg and left eye 13.08±1.57mmHg. T test is significant as p value is <0.05, showing that there is a significant fall in IOP in pre and post-delivery period of PIH. [Table 3]

There is positive correlation between IOP of both eyes and it is statistically significant(p<0.05). There is negative correlation between Systolic BP and IOP in both eyes with p value being just significant (p= 0.052,0.057). The diastolic BP is negatively correlated and is statistically insignificant.(p>0.05)

Table-4 shows positive correlation between Systolic and Diastolic BP and is statistically significant(p=0.01). There is positive correlation between IOP of both eyes and is statistically significant(p<0.05). There is negative correlation between Systolic BP and IOP in both eyes which is statistically significant(p<0.05).

The diastolic BP is negatively correlated and is statistically significant(p<0.05).

**Figure 1: Grade 3 Hypertensive retinal changes observed in a patient with Preeclampsia.**

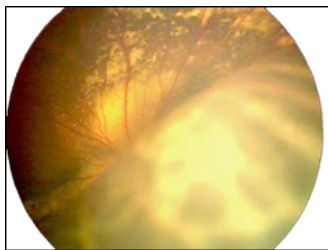


Figure 2: Exudative Retinal Detachment observed in a patient with Eclampsia.

DISCUSSION

225 patients diagnosed as PIH were observed.

The mean age-group of patients is 23.29 ± 3.47 without retinal changes, 23.56 ± 4.00 with retinal changes which matches with the study by Karki *et al*^[2] {mean age: 23.86 ± 5.51 years (with retinal changes) 24.36 ± 5.65 years (without retinal changes)}.

Age and fundus findings have been correlated ($r^2 = 6.05, P = 0.109$). Age is not associated with retinopathy changes ($P > 0.05$) which is similar to the results of Reddy *et al*^[3] and Shah *et al*^[4].

Out of 187 patients of primigravida, 115 (61.4%) patients developed fundus changes. Out of 38 patients of multigravida, 25 (65.7%) developed fundus changes.

Retinopathy is 1.14 times more common in multigravida than primigravida. Study done by Shah *et al*^[4] showed it was 2.6 times more in multigravida than in primigravida. Association of gravida with fundus findings is not statistically significant ($p = 0.348$). Gravida is not associated with fundus changes which is similar to the results of Reddy *et al*^[3] and Shah *et al*^[4].

There is higher incidence of fundus finding when the gestational age is < 24 weeks (100% patients having fundus finding) which is similar to studies done by Karki *et al*^[2] and Bakdha *et al*^[5]. In our study gestational age and fundus findings are not associated unlike other studies.

Fundus finding is more in severe preeclampsia as compared to mild preeclampsia and more in eclampsia as compared to severe preeclampsia. This is similar to Reddy *et al*^[3] and VarijaT *et al*^[6]. Severity of PIH is significantly ($P = 0.001$) associated with retinopathy which is similar to Reddy *et al*^[3], Shah *et al*^[4], VarijaT *et al*^[6] and Jayashree *et al*^[7].

54.45% of 1+ proteinuria patients showed abnormal fundus findings. 64.10% of 2+ proteinuria showed abnormal findings. 76.08% patients of 3+ proteinuria showed abnormal findings. More changes were observed as proteinuria increased, which is similar to Reddy *et al*^[3] and Shah *et al*^[4].

Proteinuria is significantly ($P = 0.039, p < 0.05$) associated with retinopathy which is similar to Karki *et al*^[2], Reddy *et al*^[3] and Shah *et al*^[4].

Tadin *et al*^[8] reported 45% of retinal changes in 40 patients with PIH. Reddy *et al*^[13] found 59% of retinal changes in 78 patients. Karki *et al*^[2] had reported 13.7% of fundus changes in 153 subjects. Rasdi *et al*^[9] found prevalence of retinopathy of 21.5%. Ranjan *et al*^[10] found 40% of retinal changes in 75 patients. Javadekar *et al*^[11] observed retinal changes in 42% of patients of PIH. In our study, it was found out to be 59% which was similar to Reddy *et al*^[3] and Bakdha *et al*^[5].

Reddy *et al*^[3] reported retinal changes in 53.4% of preeclampsia and in 71.2% of eclampsia patients. The most common fundus finding they noticed was narrowing of arterioles (45.7%). In the present study, the most common finding is arteriolar attenuation followed by arteriovenous crossing changes, haemorrhages, cotton wool spots, retinal detachment, hard exudates and macular oedema. This is similar to Bhandari *et al*^[12] and Bakdha *et al*^[5].

There was a highly significant ($P < 0.001$) association between retinopathy changes and BP in the present study which is similar to

reported by Karki *et al*^[2], Reddy *et al*^[13] and Tadin *et al*^[8].

We observed that there is a fall in IOP in immediate post-delivery period and it is statistically significant. This suggests the ocular hypotensive effect in PIH. Decrease of 6.76% in right eye and 10.66% is seen in left eye.

Phillips and associates^[13] demonstrated that the ocular hypotensive effect of late pregnancy was equivalent in women with or without systemic hypertension. In contrast, another study showed 0.6 mmHg lower mean IOP during late pregnancy in normotensive patients compared to those with hypertension^[14]. The lower IOP during the third trimester of pregnancy is also associated with a smaller amount of diurnal IOP fluctuation, as compared to non-pregnant patients.^[15] In our study, systolic and diastolic BP are negatively correlated with IOP which means as the BP increases, the IOP decreases. In study done by Ebeigbe *et al*^[16], BP did not correlate with IOP throughout the course of pregnancy ($r = -0.20$).

CONCLUSION

Hormonal changes play an important role during PIH which leads to increased BP resulting in hypertensive retinopathy. It is interesting that while in a normal physiological process an increase in BP increases the IOP, this does not hold true in pregnancy as IOP decreases in PIH patients, despite presence of hypertensive retinopathy. Most of the fundoscopic changes are reversible and resolve themselves in postpartum period. Hence, the prognosis is good in these patients.

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