

## **CORRELATION OF FUNDUS CHANGES WITH SYSTEMIC & OCULAR HYPERTENSION**

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### **ABSTRACT:**

Hypertension affects millions of patients. Persistent elevated pressure affecting the arteries and veins in eye can be the most accessible to clinically detect undiagnosed hypertension. Study is carried out to know correlation between hypertensive fundus changes with severity, duration of hypertension & intraocular pressure.

**KEYWORDS:** Hypertension, Hypertensive Retinopathy, Keith Wagner Barker Classification, Intra ocular pressure

### **INTRODUCTION:**

Hypertension affects approximately 1 billion people worldwide.<sup>1</sup> The global burden of hypertension is rising and projected to affect 1.5 billion persons – one third of the world's population by the year 2025. Hypertension despite its widely recognized high prevalence and associated danger, remains inadequately treated in majority of patients. In 90% to 95% of hypertensive patients, a single reversible cause of hypertension cannot be identified, hence the term primary (essential) hypertension. In the remaining 5% to 10% cases denoted secondary or identifiable hypertension- a more discrete mechanism can be identified.<sup>1</sup> Systemic hypertension is multi-factorial disease due to the interaction of many abnormalities in the body system. The present study carried out in 100 patients of hypertension of different etiology, attending the Guru Gobind Singh Government Hospital, Jamnagar.

### **AIMS & OBJECTIVES:**

1. Know the status of blood vessels in hypertensive patients and the severity of hypertension.
2. Know the changes in the retina in primary and secondary hypertension
3. Correlate the duration of hypertension and severity of retinopathy
4. Know the influence of systolic and diastolic pressure on intra ocular pressure.

### **MATERIAL AND METHODS:**

A randomized study is carried out over a period of 1 year at the department of Ophthalmology, Guru Gobind Singh Hospital, Jamnagar. Detailed ophthalmological assessment done along with general and systemic examination specifically systolic and diastolic blood pressure & relation of fundus changes with duration & severity of hypertension. Dilated fundus finding were noted in details, pathological changes observed in retina, retinal vasculature and optic nerve head were recorded like changes in the retinal blood vessels especially caliber of the vessels, A-V ratio, changes in vessel walls, blood column, appearance of the vascular light reflex, changes at the A-V crossing, changes in macular area and changes in background overall appearance, presence of haemorrhage, exudates or any other pathology. Thereafter attempt is made to

correlate the fundus findings with blood pressure both systolic and diastolic, intraocular pressure, etc. For hypertensive retinopathy Keith-Wagener-Barker Classification was used.

## RESULTS:

In our study, total 100 patients of different age groups of both sexes are included. In our study, systolic blood pressure below 150 mm of Hg is recorded in 18 cases (46%) of Grade-0, 8 cases (20.5%) of Grade-I, 12 cases (31%) of Grade-II & 1 case (2.5%) of Grade-III retinopathy. Systolic blood pressure between 151 to 175 mm of Hg is recorded in 15 cases (54%) of Grade-0, 4 (14%) cases of Grade-I, 6 cases (21%) of Grade-II, 2 cases (7%) of Grade-III, 1 case (4%) of Grade-IV retinopathy. Systolic blood pressure between 176 to 200 mm of Hg is recorded in 8 cases (33%) of Grade 0, 3 cases (13%) of Grade-I, 6 cases (25%) of Grade-II, 5 cases (21%) of Grade-III, 2 cases (8%) of Grade-IV retinopathy. Systolic blood pressure above 200 mm of Hg is recorded in 1 case (11.2%) of Grade 0, 2 cases (22.3%) of Grade-II, 3 cases (33.4%) of Grade-III, 3 cases (33.4%) of Grade-IV retinopathy. (Table-1)

In our study, diastolic blood pressure below 100 mm of Hg is recorded in 41 cases (55%) of Grade 0, 10 cases (14%) of Grade-I, 16 (22%) cases of Grade-II, 6 cases (8%) of Grade-III, 1 case (1%) of Grade-IV retinopathy. Diastolic blood pressure between 101 to 120 mm of Hg is recorded in 1 case (4%) of Grade 0, 5 cases (22%) of Grade I, 10 cases (44%) of Grade II, 3 cases (13%) of Grade-III, 4 cases (17%) of Grade-IV retinopathy. Diastolic blood pressure below 121-140 mm of Hg was recorded in 2 cases (67%) of Grade III, 1 case (33%) of Grade IV retinopathy. (Table-2)

The duration of hypertension of patients ranged from 1<sup>st</sup> time detected hypertension to 20 years of duration. Most (40%) of the patients were having 0-1 years of duration while 15% have 2-3 years of duration, 12% have 4-5 years of duration and only 4% patients are known case of hypertension since more than 15 years. (Table-3)

Grade-0 (normal fundus) has maximum number of cases (23) with less than 1 year of duration but seen up to 10 years of duration. Grade-I retinopathy is observed in 8 cases having hypertension of less than 1 year duration. Grade-II hypertensive retinopathy seen in 4 cases each of 0-1 year, 2-3 years, 4-5 years duration, 6 cases of 6-10 years duration, 5 cases of 11-15 years duration and 3 cases above 15 years duration. Grade-III hypertensive retinopathy seen in 4 cases of 6-10 years duration, 3 cases of 11-15 years duration and 1 case in 0-1 year duration. Grade-IV hypertensive retinopathy seen in 6 cases and all are within 5 years of duration. (Table-3)

Maximum (54 cases) of patients had intraocular pressure between 16-20 mm of Hg followed by 26 cases had 11-15 mm of Hg and 20 cases have intraocular pressure between 21-25 mm of Hg. Intraocular pressure between 11-15 mm of Hg was recorded in 4 cases of Grade-0 and Grade-I each, 9 cases of Grade-II, 6 cases of Grade-III and 3 cases of Grade-IV hypertensive retinopathy. Intraocular pressure between 16-20 mm of Hg is recorded in 28 cases of Grade-0, 8 cases of Grade-I, 12 cases of Grade-II, 4 cases of Grade-III and 2 cases of Grade-IV hypertensive retinopathy. Intraocular pressure between 21-25 mm of Hg is recorded in 10 cases of Grade-0, 3 cases of Grade-I, 5 cases of Grade-II, 1 case of Grade-III and 1 case of Grade-IV hypertensive retinopathy. Intraocular pressure above 25 mm of Hg was not recorded in any case. There is no direct relation between intraocular pressure and severity of hypertensive retinopathy. (Table-4)

Study shows that systolic blood pressure below 150 mm of Hg is found in 39 cases of which 16 cases have intraocular pressure between 11-15 mm of Hg, 16 cases have intraocular pressure between 16-20 mm of Hg, 16 cases have intraocular pressure between 21-25 mm of Hg. Systolic blood pressure between 151-175 mm of Hg is found in 28 cases which include 9 cases that have intraocular pressure between 11-15 mm of Hg, 13 cases that have intraocular pressure between 16-20 mm of Hg, 6 cases have intraocular pressure between 21-25 mm of Hg. Systolic blood pressure between 176-200 mm of Hg is found in 24 cases includes 1 case having intraocular pressure between 11-15 mm of Hg, 20 cases having intraocular pressure between 16-20 mm of Hg, 3 cases having intraocular pressure between 21-25 mm of Hg. Systolic blood pressure above 200 mm of Hg is found in 9 cases includes 5 cases that have intraocular pressure between 16-20 mm of Hg

and 4 cases have intraocular pressure between 21-25 mm of Hg. No case had intraocular pressure above 25mm of Hg.

Diastolic blood pressure below 100 mm of Hg is found in 74 cases which includes 22 cases having intraocular pressure between 11-15mm of Hg, 39 cases having intraocular pressure between 16-20mm, 7 cases having intraocular pressure between 21-25mm Hg. Diastolic blood pressure between 101-120mm of Hg is found in 23 cases includes 4 cases having intraocular pressure between 11-15mm of Hg, 12 cases having intraocular pressure between 16-20 mm of Hg, 7 cases having intraocular pressure between 21-25mm of Hg. Diastolic blood pressure between 121-140 mm of Hg is found in 3 cases, all 3 cases have intraocular pressure between 16-20 mm of Hg.

## DISCUSSION:

Most(40%) of the patients were having 0-1 years of duration while 15% have 2-3 years of duration, 12% have 4-5 years of duration and only 4% patients are known case of hypertension since more than 15 years. Grade-0(normal fundus) has maximum number of cases(23%) with less than 1 year duration, but seen up to 10 years of duration. Grade-I retinopathy were mostly observed in patients with hypertension of less than 1 year duration. Grades II and III retinopathy were seen in cases with varying duration of hypertension and 4 cases out of 6 cases of Grade-IV retinopathy were of 0-1 year duration. Jagmohan Singh, M K Tewari, P K Khosla, Rajvardhan Azad in their study<sup>[2]</sup> showed Grade-I(20%) and Grade-II(22%) retinopathy with less than 1 year duration of hypertension. Grade-III have varying duration of hypertension and Grade-IV retinopathy (8%) with about a year's duration of hypertension. MUHAMMAD ZAKRIA(2004)<sup>[3]</sup> in their study found that prevalence of hypertensive retinopathy increases with the duration of hypertension and was maximum in patients with duration of 10 years. In our study and the S K Lal, IS Jain, SD Gupta, PL Wahi study<sup>[4]</sup>, Grade-IV hypertensive retinopathy is observed in patients having hypertension less than 1 year duration which means that it develops in accelerated hypertension rather than in cases with long duration or might be due the low survival expectancy in these individuals.

In the study(Table-1), systolic blood pressure below 150 mm of Hg is noted in maximum number of cases(39%) of which 46% have no retinopathy, 2.5% have Grade-III hypertensive retinopathy and Grade-IV retinopathy is not seen. Systolic blood pressure between 151-200 mm of Hg have majority(50%) of Grade-0 and less cases of Grade-III, Grade-IV retinopathy. Systolic pressure above 200 mm of Hg have majority of cases Grade-III(33.4%) and Grade-IV(33.4%) retinopathy.

Diastolic blood pressure below 100 mm of Hg is found in 74%cases of which 41(55%)cases have Grade-0(normal fundus) and less cases of Grade-III(8%) and Grade-IV(1%)hypertensive retinopathy. Grade-III and Grade-IV retinopathy is more common with increase in diastolic blood pressure than Grade-I and Grade-II retinopathy.

In our study, maximum cases of Grade-0(67%), Grade-I(53%) have intraocular pressure between 16-20mm of Hg and maximum cases of Grade-III(55%) and Grade-IV(50%) have intraocular pressure between 11-15 mm of Hg. From 42 cases of Grade-0, 10% cases have intraocular pressure between 11-15 mm of Hg, 67% cases have intraocular pressure between 16-20, 3% cases have intraocular pressure between 21-15mm of Hg. From 15 cases of Grade-I, 27% cases have intraocular pressure between 11-15 mm of Hg, 53% cases have intraocular pressure between 16-20, 20% cases have intraocular pressure between 21-15 mm of Hg. From 26 cases of Grade-II, 35% cases have intraocular pressure between 11-15 mm of Hg, 46% cases have intraocular pressure between 16-20, 19% cases have intraocular pressure between 21-15 mm of Hg. From 6 cases of Grade-IV, 50% have intraocular pressure between 11-15 mm of Hg, 33% cases have intraocular pressure between 16-20 mm of Hg and 17% cases have intraocular pressure between 21-15mm of Hg. In the study by S K Lal, IS Jain, SD Gupta, PL Wahi<sup>[4]</sup> intraocular pressure showed a gradual fall with increasing severity of hypertensive changes except in purely arteriosclerotic group.

In our study, systolic blood pressure of <150 mm of Hg were found with intraocular pressures between 11-15 mm of Hg in 16 cases, 16-20 mm of Hg in 16 cases and 21-25 mm of Hg in 7 cases. Systolic blood pressure



above 200 mm of Hg have intraocular pressure between 16-20 mm of Hg in 5 cases and 21-25 mm of Hg in 4 cases.

Diastolic blood pressure below 100 mm of Hg is found in 74 cases which includes maximum cases (39 cases) having intraocular pressure between 16-20 mm of Hg followed by 22 cases having 11-15 mm of Hg, 13 cases having 21-25 mm of Hg. Diastolic blood pressure above 100 mm of Hg found in 26 cases, maximum cases(15 cases) have intraocular pressure between 16- 20 mm of Hg. Only 4 cases have intraocular pressure between 11-15 mm of Hg, 7 cases have intraocular pressure between 21-25 mm of Hg. Klein BE, Klein R, Knudtson study<sup>[5]</sup> showed that intraocular pressures were significantly correlated with systolic and diastolic blood pressures. There were significant direct correlations between changes in systemic pressures and changes in intraocular pressure. There was a 0.21 mm of Hg increase in IOP for a 10 mm of Hg increase in systolic and 0.43 mm of Hg increase in IOP for a 10 mm increase in diastolic blood pressure. Systolic blood pressure was positively associated with intraocular pressure in Barbados eye study<sup>[6]</sup>. similarly in the Baltimore longitudinal study of aging(BLSA)<sup>[6]</sup> and in 2 large Japanese studies that included normal subjects, the intraocular pressure changes was positively correlated with change in systolic blood pressure.

### CONCLUSION:

One hundred cases of systemic hypertension were examined to study their correlation with pressure both systolic and diastolic, intraocular pressure, etc.

Grade-IV hypertensive retinopathy is observed in patients having hypertension less than 1 year duration which means that it develops in accelerated hypertension rather than in cases with long duration or might be due the low survival expectancy in these individuals. No direct correlation is observed between the duration of hypertension and severity of hypertensive retinopathy.

Systolic blood pressure below 150 mm of Hg is noted in maximum number of cases(39%) of which 46% have no retinopathy. No Grade-IV retinopathy associated with systolic blood pressures below 150mm of Hg. Systolic blood pressure between 151-200 mm of Hg have majority of cases(50%) Grade-0 and less cases of Grade-III & IV retinopathy. Grade-III and Grade-IV hypertensive retinopathy is more common with increase in systolic blood pressure than Grade-I and Grade-II retinopathy.

Diastolic blood pressure below 100 mm of Hg is found in 74% cases of which 41(55%) cases have Grade-0(normal fundus) and less cases of Grade-III(8%) and Grade-IV(1%) hypertensive retinopathy. Grade-III and Grade-IV retinopathy is more common with increase in diastolic blood pressure than Grade-I and Grade-II retinopathy. Grade-III and Grade-IV retinopathy is more common with increase in diastolic blood pressure than Grade-I and Grade-II retinopathy.

There is no direct correlation observed between intraocular pressure and systolic blood pressure and diastolic blood pressure.

### REFERENCES:

1. Ronald G.Victor, systemic hypertension : mechanisms & diagnosis, Eugene Braunwald's Heart Disease, A textbook of cardiovascular medicine 9<sup>th</sup> edition, 2011:935-943.
2. Jagmohan Singh, MK Tewari, P K Khosla, R Ajvardhan Azad Hypertensive retinopathy, Indian journal of Ophthalmology, 1983, Volume:31, Page:971-974
3. MUHAMMAD ZAKRIA Prevalence of retinopathy in hypertensive patients The professional Medical Journal, 2004, Volume:11, Page no. 267-272
4. S K Lal, IS Jain, SD Gupta, PL Wahi Role of local factors in hypertensive retinopathy, Indian Journal of ophthalmology, 1974, Volume:22, Page:1-5
5. Klein BE, Klein R, Knudtson MD intraocular pressure and systolic blood pressure: longitudinal perspective: the Beaver Dam Eye Study, British Journal of ophthalmology, 2005 Mar; 89(3):284-7
6. Gunn M: On ophthalmoscopic evidence of general arterial disease. Trans Ophthalmol Soc UK 18:356, 1898

**TABLE-1 SHOWING RELATIONSHIP BETWEEN VARYING GRADES OF HYPERTENSIVE RETINOPATHY (KEITH WAGENER BARKAR CLASSIFICATION) & SYSTOLIC BLOOD PRESSURE**

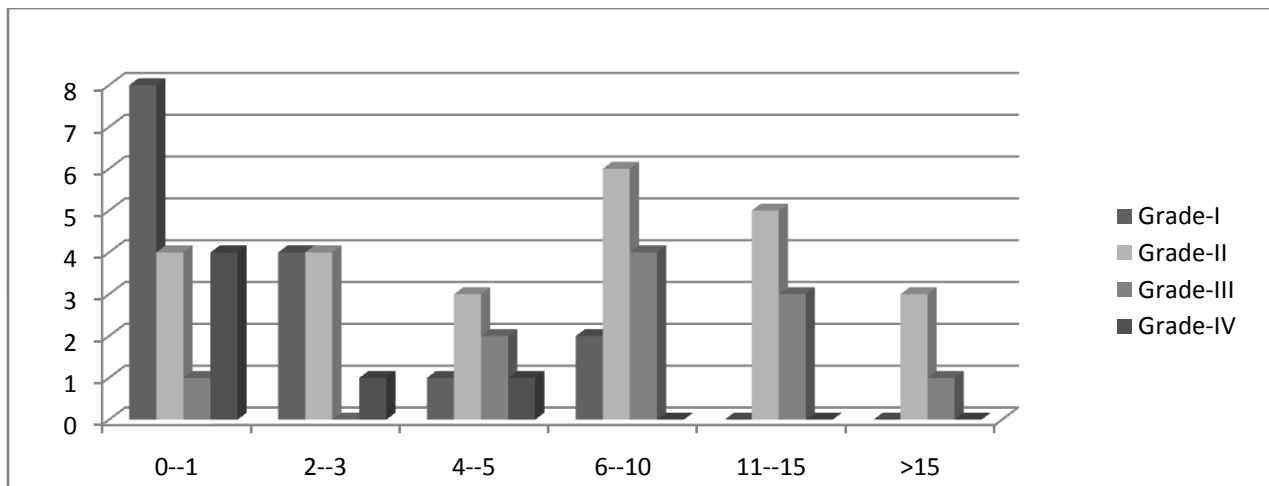
Systolic B.p(mm of Hg)	Grades of Hypertension					Total
	0	I	II	III	IV	
Up to 150	18 (46%)	8 (20.5%)	12 (31%)	1 (2.5%)	-	39
151-175	15 (54%)	4 (14%)	6 (21%)	2 (7%)	1 (4%)	28
176-200	8 (33%)	3 (13%)	6 (21%)	5 (21%)	2(8%)	24
>200	1(11.2%)	-	2 (22.3%)	3 (33.4%)	3 (33.4%)	9
Total	42	15	26	11	6	100

**TABLE 2: SHOWING RELATIONSHIP BETWEEN GRADES OF RETINOPATHY (KEITH WAGENER BARKAR CLASSIFICATION) AND DIASTOLIC BLOOD PRESSURE**

Diastolic B.P(mm of Hg)	Grades of Hypertensive Retinopathy					Total
	0	I	II	III	IV	
Up to 100	41 (55%)	10 (14%)	16 (22%)	6(8%)	1(1%)	74
101-120	1 (4%)	5 (22%)	10 (44%)	3 (13%)	4 (17%)	23
121-140	-	-	-	2 (67%)	1 (33%)	3
Total	42	15	26	11	6	100

**TABLE -3: CORRELATION BETWEEN GRADES OF HYPERTENSIVE RETINOPATHY(KEITH WAGENER BARKER CLASSIFICATION) & KNOWN DURATION OF HYPERTENSION**

Grade	Duration of hypertension in years						Total
	0-1	2-3	4-5	6-10	11-15	>15	
0	23 (23%)	6 (6%)	4 (4%)	9 (9%)			42
I	8 (8%)	4 (4%)	1 (1%)	2 (2%)			15
II	4 (4%)	4 (4%)	4 (4%)	6 (6%)	5 (5%)	3 (3%)	26
III	1 (1%)		2 (2%)	4 (4%)	3 (3%)	1 (1%)	11
IV	4 (4%)	1 (1%)	1 (1%)	-	-	-	6
TOTAL	40	15	12	21	8	4	



**TABLE-4: RELATIONSHIP OF INTRAOCULAR PRESSURE IN DIFFERENT GRADES OF HYPERTENSIVE RETINOPATHY (KEITH WAGENER BARKAR CLASSIFICATION)**

Grades of hypertensive retinopathy	Number of patients showing intraocular pressure(mm of Hg)				Total number of patients
	11-15	16-20	21-25	>25	
Grade 0	4 (10%)	28 (67%)	10 (3%)	-	42
Grade I	4 (27%)	8 (53%)	3 (20%)	-	15
Grade II	9 (35%)	12 (46%)	5 (19%)	-	26
Grade III	6 (55%)	4 (36%)	1 (9%)	-	11
Grade IV	3 (50%)	2 (33%)	1 (17%)	-	6
Total	26	54	20	-	100

**TABLE-5: SHOWING RELATION OF INTRAOCULAR PRESSURE AND SYSTOLIC BLOOD PRESSURE**

Systolic blood pressure	Number of patients showing intraocular pressure(mm of Hg)				Total no. of patients
	11-15	16-20	21-25	>25	
<150	16	16	7	-	39
151-175	9	13	6	-	28
176-200	1	20	3	-	24
>200	-	5	4	-	9
Total	26	54	20	-	100

**TABLE-6: SHOWING RELATION OF INTRAOCULAR PRESSURE AND DIASTOLIC BLOOD PRESSURE**

Diastolic blood pressure	Number of patients showing intraocular pressure(mm of Hg)				Total no. of patients
	11-15	16-20	21-25	>25	
<100	22	39	13	-	74
101-120	4	12	7	-	23
121-140	-	3	-	-	3
Total	26	54	20	-	