



Original Article

Evaluation of Visual Functions in Advanced Hypertensive Patients.

A Authors

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Purpose: To check status of various visual functions (visual acuity, contrast sensitivity, colour vision, glare and visual fields) in people having hypertension for 10 to 15 years.

Method: A descriptive cross-sectional study was conducted among 50 people diagnosed as having hypertension for 10 to 15 years and presenting at Mayo Hospital Lahore were examined. All the visual functions were measured. Visual acuity was measured using log MAR charts, color vision by Ishihara color plates, contrast sensitivity by Lea number contrast sensitivity plates, visual field by arc handheld perimeter, and glare by the patient's complaint.

Results: Records of 50 patients who were involved in our study were reviewed. Out of 50 patients, 18 were male and 32 were female and they were in age between 20-70 years. The distant visual acuity table showed Visual acuity of 0.00-0.50 log MAR in 20 patients, 0.6-1.00 log MAR in 19 patients and 1.1-1.5 log MAR in 11 patients. The near VA table showed that 1M-2M in 19 patients, 3M-6M in 13 patients and 8M-16M in 18 patients. The color vision table showed that 1/12 CV in 20 patients, 4/12 in 16 patients, 8/12 in 7 patients and 12/12 in 5 patients in both eyes. Contrast sensitivity table showed that that 25% contrast sensitivity in 11 patients, 10% in 13 patients, 5% in 15 patients, 2.5% in 4 patients and 1.25% in 7 patients in right eye and in left eye 25% in 8 patients, 10% in 11 patients, 5% in 11 patients 2.5% in 10 patients and 1.25% in 10 patients. The visual field table showed that 25 patients had a normal visual field and 25 had constricted visual field in both eyes. Glare sensitivity table showed that 27 patients had a complaint of glare and 23 had no glare. The p-value for all the parameters was less than 0.05 which showed that hypertension is associated with disturbance in visual functions.

Conclusion: All the visual functions are affected to some extent by hypertension. Of these, color vision and contrast sensitivity are affected the most, while visual field and glare are affected in 50% of patients. Visual acuity is least affected.

Introduction:

More than 1 million people around the world are affected by hypertension. It is a systemic disease.¹ If the systolic blood pressure is above 140 mm Hg and diastolic blood pressure is above 90 mm Hg then it is called hypertension. Advanced hypertension is the advance stage of hypertension. Hypertension has many asymptomatic and multisystemic effects. The eye is also affected by high blood pressure.²

Hypertension affects the ocular structures and functions because due to high blood pressure the vascular system of retina, choroid, and optic nerve go through a sequence of pathophysiological adjustments, which causes many clinical signs called the hypertensive retinopathy, hypertensive choroidopathy, and hypertensive optic neuropathy.³

Evaluation of visual functions is the term used to evaluate how the eye and the visual system functions. It is used to determine how our eye performs. It is the capacity to process the visual stimulus.

The basic methods of assessing visual functions are visual acuity, color vision, contrast sensitivity, visual field, and glare. The visual functions abnormalities include the decreased vision, reduced contrast sensitivity, abnormal color vision, peripheral visual field loss and electrophysiological changes.⁴

The different visual functions may become impaired independent of each other. Therefore there are many different types of visual impairment and disabilities. Infarctions and microangiopathy in hypertension leads to retinal nerve fiber layer damage and impairment of visual functions.⁵ Loss of visual functions is the main complication in idiopathic intracranial hypertension and may occur early or late in its course. So the visual functioning test should be recorded.⁶

Diseases affecting the center of the retina or the related optic nerve pathways are likely to cause decreased visual acuity and therefore visual acuity has customarily been utilized as the essential indicator of the magnitude of functional disability due to vision loss. However, in describing the visual function impairments, contrast sensitivity at different spatial frequencies may be more sensitive than Snellen visual acuity.⁷

Perception of colors begins with the specialized retinal cells known as the cone cells.⁸ Inability to differentiate colors may make objects less discernible. Many studies have shown that there is a positive association between systemic hypertension and color vision. For evaluating color discrimination, a variety of tests is available. Visual field defects are the direct expressions of pathological changes in the optic nerve and optic nerve head.⁹ There are anatomical, physiological and pathological factors that are related to the

microcirculation and autoregulation leading to hypertensive retinopathy.¹⁰

Methodology:

Ethical clearance to conduct the study was obtained from the College of Ophthalmology and Allied Vision Sciences, King Edward Medical University Lahore. A descriptive cross-sectional study was conducted among 50 people having hypertension of 10 to 15 years' duration and presenting to Mayo Hospital Eye OPD Lahore. They were in age between 20-70 years. The participants who were mentally retarded and having other ocular problems were excluded from the study. A consent form in English (verbally explained in Urdu by the researcher) containing information related to purpose, significance, and procedure was completed and signed by each participant. A proforma was filled by collecting data through clinical examination from patients. After the complete history.

Visual acuity was measured using log MAR charts, color vision by Ishihara color plates, contrast sensitivity by Lea number contrast sensitivity plates, visual field by arc handheld erimeter, and glare by a patient's complaints.

The data was collected using SPSS Version 20. The evaluation of visual functions among advanced hypertensive patients was derived from the data. A descriptive cross-sectional study was done using tests to evaluate the visual functions among advanced hypertensive patients. To maintain confidentiality the use of code rather than the participant's name was employed.

Distant Visual Acuity Range:

Table 1: Visual Acuity for Far In Left Eye By Age

	age					Total
	20-30 years	30-40 years	40-50 years	50-60 years	60-70 years	
0.0	0	0	1	2	0	3
0.1	2	2	0	1	0	5
0.2	2	1	0	0	0	3
0.3	0	1	0	3	0	4
0.4	0	0	1	2	1	4
0.5	0	1	1	1	0	3
0.6	0	0	2	0	1	3
0.7	0	0	2	0	1	3
0.8	0	1	1	1	0	3
0.9	1	0	1	0	3	5
1.00	0	0	0	2	2	4
1.1	0	0	0	1	0	1
1.2	0	0	0	0	1	1
1.3	0	0	1	1	2	4
1.4	0	0	0	1	1	2
1.5	0	0	1	0	1	2
Total	5	6	11	15	13	50

This table shows the distant VA range in the left eye in different age groups. It shows 0.00-0.50 VA in 22 patients, 0.50-1.00 VA in 18 patients and 1.1-1.50 VA in 10 patients.

Near Visual Acuity Range:

Table 2: Near Visual Acuity of Right Eye by Age

	age					Total
	20-30 years	30-40 years	40-50 years	50-60 years	60-70 years	
1M	1	0	0	0	1	2
1.2M	1	3	0	0	0	4
1.6M	2	2	0	0	1	5
2M	0	1	4	3	0	8
3M	0	0	5	1	0	6
4M	0	0	1	0	0	1
5M	0	0	0	3	2	5
6M	0	0	0	1	0	1
8M	0	0	0	4	1	5
12M	0	0	1	1	4	6
13M	0	0	0	1	2	3
16M	1	0	0	1	2	4
Total	5	6	11	15	13	50

This table shows the near visual acuity range in the right eye in different age groups. It shows that 1M-2M acuity in 19 patients, 3M-6M in 13 patients and 8M-16M in 18 patients.

Near Visual Acuity Range:

Table 3: Near Visual Acuity of Left Eye by Age

	Age					Total
	20-30 years	30-40 years	40-50 years	50-60 years	60-70 years	
1M	1	1	0	0	0	2
1.2M	1	3	0	1	1	6
1.6M	1	1	0	1	0	3
2M	1	1	3	3	0	8
2.5M	1	0	0	1	0	2
3M	0	0	4	0	0	4
4M	0	0	2	0	1	3
5M	0	0	0	2	1	3
6M	0	0	0	1	0	1
8M	0	0	0	2	0	2
10M	0	0	0	1	0	1
12M	0	0	2	1	2	5
13M	0	0	0	0	1	1
16M	0	0	0	2	7	9
Total	5	6	11	15	13	50

This table shows the near visual acuity range in the right eye in different age groups. It shows that 1M-2M acuity in 19 patients, 3M-6M in 13 patients and 8M-16M in 18 patients.

Near Visual Acuity Range:

Table 3: Near Visual Acuity of Left Eye by Age

	Age					Total
	20-30 years	30-40 years	40-50 years	50-60 years	60-70 years	
1M	1	1	0	0	0	2
1.2M	1	3	0	1	1	6
1.6M	1	1	0	1	0	3
2M	1	1	3	3	0	8
2.5M	1	0	0	1	0	2
3M	0	0	4	0	0	4
4M	0	0	2	0	1	3
5M	0	0	0	2	1	3
6M	0	0	0	1	0	1
8M	0	0	0	2	0	2
10M	0	0	0	1	0	1
12M	0	0	2	1	2	5
13M	0	0	0	0	1	1
16M	0	0	0	2	7	9
Total	5	6	11	15	13	50

This table shows the near visual acuity range in the left eye in different age groups. It shows that 1M-2M acuity in 19 patients, 2.5 M-6M in 13 patients and 8M-16M in 18 patients.

Color Vision Range:

Table 4: Color Vision for Right Eye by Age

	age					Total
	20-30 years	30-40 years	40-50 years	50-60 years	60-70 years	
1/12	2	1	4	7	8	22
4/12	0	3	2	6	5	16
8/12	1	2	3	1	0	7
12/12	2	0	2	1	0	5
Total	5	6	11	15	13	50

This table shows the color vision of right in different age groups. It shows that 1/12 color vision 22 patients, 4/12 in 16 patients, 8/12 in 7 patients and 12/12 in 5 patients.

Table 5: Color Vision for Left Eye * Age

	Age					Total
	20-30 years	30-40 years	40-50 years	50-60 years	60-70 years	
1/12	0	1	4	6	8	19
4/12	2	2	3	5	5	17
8/12	0	2	3	3	0	8
12/12	3	1	1	1	0	6
Total	5	6	11	15	13	50

This table shows the color vision of the left eye in different age groups. It shows that 1/12 color vision in 19 patients, 4/12 in 17 patients, 8/12 in 8 patients and 12/12 in 6 patients.

Contrast Sensitivity Range:**Table 6: Contrast Sensitivity for Right * Age**

	Age					Total
	20-30 years	30-40 years	40-50 years	50-60 years	60-70 years	
25%	0	1	3	2	5	11
10%	1	2	1	6	3	13
5%	1	2	3	4	5	15
2.5%	0	1	2	1	0	4
1.25%	3	0	2	2	0	7
Total	5	6	11	15	13	50

This table shows the contrast sensitivity range in the right eye in different age groups. It shows that 25% contrast sensitivity in 11 patients, 10% in 13 patients, 5% in 15 patients, 2.5% in 4 patients and 1.25% in 7 patients.

Table 7: Contrast Sensitivity for Left * Age

	Age					Total
	20-30 years	30-40 years	40-50 years	50-60 years	60-70 years	
25%	0	0	2	2	4	8
10%	0	1	4	3	3	11
5%	1	1	2	2	5	11
2.5%	1	1	3	4	1	10
1.25%	3	3	0	4	0	10
Total	5	6	11	15	13	50

This table shows the contrast sensitivity range in the left eye in different age groups. It shows that 25% in 8 patients, 10% in 11 patients, 5% in 11 patients 2.5% in 10 patients and 1.25% in 10 patients.

Visual Field Range**Table 8: Visual Field of Right Eye by Age**

	Age					Total
	20-30 years	30-40 years	40-50 years	50-60 years	60-70 years	
Constricted	2	2	4	8	10	26
Normal	3	4	7	7	3	24
Total	5	6	11	15	13	50

This table shows the visual field of the right eye in different age groups. It shows that out of 50 patients 26 had a constricted visual field and 24 had a normal visual field.

Table 9: Visual Field of Left Eye by Age

	Age					Total
	20-30 years	30-40 years	40-50 years	50-60 years	60-70 years	
Constricted	0	2	5	7	10	24
Normal	5	4	6	8	3	26
Total	5	6	11	15	13	50

This table shows the visual field in the left eye in different age groups. It shows that out of 50 patients 24 had a normal visual field and 26 had a constricted visual field.

Glare Sensitivity Range;**Table 10: Both Eyes Glare by Age**

		Age					Total
		20-30 years	30-40 years	40-50 years	50-60 years	60-70 years	
Glare	Yes	2	3	5	8	9	27
	No	3	3	6	7	4	23
Total		5	6	11	15	13	50

	Sig. (2-tailed)	Mean Difference
Visual acuity for far in the right eye	.000	8.04000
Visual acuity for far in the left eye	.010	7.70000
Color vision for the right eye	.000	1.90000
Color vision for the left eye	.000	2.02000
Contrast sensitivity for the right eye	.030	2.66000
Contrast sensitivity for the left eye	.000	3.06000
The visual field of the right eye	.000	1.48000
The visual field of the left eye	.000	1.52000
Glare	.000	1.46000
Near visual acuity of the right eye	.000	7.32000
Near visual acuity of the left eye	.000	7.54000
Duration of hypertension	.000	12.42000



In this study we applied one-sample t-test, the results shows that there is significant effect of hypertension on visual functions i.e. visual acuity(0.00), color vision(0.000), contrast sensitivity(0.030), visual field(0.00), and glare(0.00). The p-value of less than 0.05 is considered significant. So the p-value for all the parameters is 0.00 which shows the significant association of hypertension with visual functions.

Discussion:

Hypertension is defined as systolic blood pressure of more than 140mmHg and diastolic blood pressure of more than 90mmHg. Advance hypertension is the advance stage of hypertension.¹

Evaluation of visual functions is the term used to evaluate how the eye and the visual system functions. It is used to determine how our eye performs. It is the capacity to process the visual stimulus.²

In our study, diagnosed hypertensive patients who have hypertension from 10-15 years or more were included. Patients having the blood pressure of more than 140/90 and/ or they are taking antihypertensive medicines. Five tests to assess the visual functions of the patients which are Visual acuity, Color vision, Contrast sensitivity, Visual field, and Glare sensitivity were conducted. This study shows that all the visual functions are affected by hypertension more or less. There is a lot of variability in decreasing the visual field between different patients.¹¹ Glare is a decrease in the contrast of the retinal image due to the external bright light source present in the visual field. The concentration of the light relies upon the region and the luminance of the glare source.

In 2015, a study of American journal Hypertension stated that in middle-aged men hypertension badly affects vision-related neuronal functions. In this study, it is stated that there is a significant Co-relation between blood pressure level and acquired color vision impairment prevalence after adjusting for systemic parameters such as body mass index, cholesterol level, and other ophthalmic diseases.¹²

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