

## Fundus fluorescein angiography in patients having diabetes with hypertension- An evaluation

Sangeeta Agarwal<sup>1\*</sup>, Shika Singh<sup>2</sup>

<sup>1</sup>Associate Professor, <sup>2</sup>Senior consultant, Dept. of Ophthalmology, <sup>1</sup>Government medical college Azamgarh, <sup>2</sup>Park Hospital Gurgaon

**\*Corresponding Author:**

Email: sangeetaeyecare@gmail.com

### Abstract

**Objective:** To study the variations, changes and rate of progression in the fundus findings of patients having diabetes and hypertension both, and to compare these findings from those having diabetes alone.

**Result:** FFA was done on total 30 patients, which were divided into two groups A and B there was male dominance (17. 56.6%). Majority of patients are in 50-70yr. age group. In group A, only 2 patients had Type-1 diabetes, rest had Type-2. In group A., maximum patient had history of duration of 20-60yr. where as in group B it is 10-20yr. In both groups mostly patients were on irregular treatment. Main FFA findings in both groups are Micro aneurysms and hard exudates, Hypertension was significantly related to retinopathy and both systolic and diastolic blood pressures were deemed to have an association.

**Keywords:** Hard exudates, Fundus fluorescein angiography, Microaneurysm.

### Introduction

World Health Organization (WHO) states that India will have over 50 million people with diabetes by 2025. Among these 50 million, approximately 20 million will have eye diseases due to diabetes. Diabetic retinopathy is a microvascular disorder in which the endothelial cells malfunction owing to chronic exposure to high levels of glucose and other factors. As diabetic retinopathy progresses, there is a gradual closure of retinal vessels, which results in impaired perfusion and retinal ischemia. Retinal arterioles and capillaries are similar in anatomy to cerebral vessels in that they exhibit auto-regulatory mechanisms and tight junctions to maintain the blood-ocular barrier.

Hypertension is a leading cause of morbidity and mortality worldwide. This vascular condition involves every organ system. The retina is one of the “target organs” that are damaged by sustained hypertension. Malignant hypertension may cause sudden symptoms, and should be considered a medical emergency.<sup>(1)</sup> Hypertension and hyperglycemia directly damage the microvasculature, leading to small vessel dysfunction that manifests as the clinical disease states of diabetic retinopathy and nephropathy.

Improved understanding of the role of hypertension in the pathogenesis of diabetic retinopathy presents both a challenge and an opportunity for ophthalmologists and other diabetic healthcare professionals to improve patient care.

Seeing is believing. This applies to investigations like fluorescein angiography, as it allows us to see details of retina which is not visible with naked eyes. Fluorescence is a property of substance to alter the wavelength of the reflected light on exciting.<sup>(2)</sup>

This is an important invasive diagnostic procedure, when a dye is injected into a vein in the arm or hand

and sets of digital photographs are taken to display the blood vessels at the back of the eye.<sup>(3)</sup>

Depending on the various features seen, whether we get leakages or staining or blocked fluorescence or window defects, whether the dye is seen in early phase, late phase or in very late phase or delayed phase and is initially less and increasing etc, we can get a very good idea of patients disease.<sup>(4)</sup>

### Materials and Methods

#### Patient Selection:

- Patients who were known diabetic for more than 10 years. Both Type-1 and Type-2 diabetic patients were included.
- Patients who were known diabetics for more than 10 years and also developed hypertension irrespective of duration.

Patients having diabetes for less than 10 years were not included because diabetes takes 8 to 10 years on an average to cause visible damage in the retina. These patients were divided into two groups A and B. in group A, patients having diabetes were included and in group B, patients having diabetes along with hypertension were included.

After taking consent from all the patients, they were thoroughly examined with special emphasis on duration of the disease with duration of treatment. A detailed medical history was taken; followed by, visual acuity by snellen’s chart, refraction, anterior segment examination by Slit lamp, Intraocular pressure measured by Schiottz tonometer, fundus evaluation with direct ophthalmoscope, slit Lamp biomicroscopy with 90D, indirect ophthalmoscopy, The Diabetic retinopathy in the eyes of patients who had met the inclusion criteria were graded based on International Clinical diabetic retinopathy disease severity scale.

Blood pressure grading was done according to Joint National Committee-(JNC-7) on prevention detection evaluation and treatment of high blood pressure,<sup>(5)</sup> The chemical dye was injected in the vein of the hand or arm (medial cubital vein) and this dye circulated all over the body and in every blood vessel. Since retina is the only place in the body where blood vessels can be seen, it is used to visualize the retinal vasculature that is blood vessels of the retina. A special machine called the fundus camera, which has got special lens filters, was used to take photographs of the retina.<sup>(6)</sup> We also attached a digital camera system and a printer. When blue light falls on retina which has Fluorescein dye the reflected light is of green colour & not blue. This property of dye was used to study the normal or abnormal anatomy of retina.<sup>(7,8)</sup>

**Observations**

A study of 30 patients was performed with the aim to compare the fundus fluorescein angiography findings in patients having diabetes with those having hypertension along with diabetes. This study was done by using a high quality of fundus camera with computerized digital system and fluorescein dye.

**Table 1: Showing duration and treatment status**

	Patient of DM		DM with Hypertension	
	No.	%	No.	%
<b>Duration of disease (years)</b>				

10-20	05	38.46	11	64.7
20-30	06	46.15	05	29.41
>30	02	15.38	01	5.88
<b>Treatment Status</b>				
Regular	02	15.39	06	35.29
Irregular	06	46.15	09	52.94
No Treatment	05	38.46	02	11.77

**Table 2: Stages in Patients of Diabetes and in Patients of Diabetes and Hypertension Both (Comparison)**

Stages	Diabetic patient		Diabetes mellitus with hypertension	
	No.	%	No.	%
Mild NPDR	05	38.8	03	17.0
Moderate NPDR	04	30.0	05	29.0
Severe NPDR	02	15.0	04	23.0
PDR	01	07.0	04	23.0
Diabetic Maculopathy	03	23.0	08	47.0
Hypertensive Retinopathy			07	41.0

In group A, Maximum Patients has mild to moderate NPDR, but in group B majority presented with diabetic maculopathy followed by hypertensive retinopathy.

**Table 3: Blood Pressure Levels of Patients in Various Stages**

Stages	Total No. of Patients	Systolic BP (mmHg)			Diastolic BP (mmHg)		
		120-140	140-160	>160	80-90	90-100	>100
Mild NPDR	03	01	01	01	01	02	
Moderate NPDR	05		03	02		04	01
Severe NPDR	04		02	02		02	02
PDR	04		01	03		01	03
Diabetic maculopathy	08		05	03		04	04
Hypertension retinopathy	07		03	04		04	03

Majority of patients with high systolic and diastolic blood pressure values were found in later and severe stage of diabetes.

**Table 4: Findings in Patients having Diabetes and Hypertension both and diabetes alone (Ophthalmoscopic Findings)**

Findings	DM + HTN		DM	
	No.	%	No.	%
Sheathing	12	70.0	04	30.77
Blockage	03	17.0	01	07.69
Leaking	00	00.0	00	00.00
Papilloedema	00	00.0	00	00.00

Silver wiring	01	05.0	00	00.00
Maculopathy	10	58.0	03	23.08
Microaneurysms	17	100.0	13	100.0
Hard exudates	17	100.0	11	84.62
Dot hemorrhages	08	47.0	08	61.54
Blot hemorrhages	11	64.0	05	38.46
Flame shaped hemorrhages	14	82.0	04	30.77
Cotton wool spots	05	29.0	01	07.69
NVE	03	17.0	01	07.69
NVD	04	23.0	00	00.00
Salus sign	07	42.0	00	00.00
Gunn sign	04	23.0	00	00.00

**Table 5: Fundus Fluorescein Angiographic Findings in Diabetic Patients**

		No.	%
Hyperfluorescent dots	Microaneurysms	13	100.0
Hypofluorescent spots	Dot and blot hemorrhages	13	100.0
Hypofluorescent elongated areas	Flame shaped hemorrhages	04	30.0
Focal hypofluorescent areas	Cotton wool spots	01	07.0
Non focal hypofluorescent areas	Hard exudates	11	84.0
Diffuse hyperfluorescence at macular area	Macular edema	03	23.0
Leaking		04	30.0
Blockage		01	07.0
Hyperfluorescent vessels with leaking in later phases	NVD	00	00.0
	NVE	01	07.0
Total patients		13 Patients	

**Table 6: Fundus Fluorescein Angiographic Findings in Patients of Diabetes with Hypertension**

		No.	%
Hyperfluorescent dots	Microaneurysms	17	100.0
Hypofluorescent spots	Dot and blot hemorrhages	17	100.0
Hypofluorescent elongated areas	Cotton wool spots	5	29.0
Non focal hypofluorescent areas	Hard exudates	17	100.0
Diffuse hyperfluorescence at macular area	Macular edema	10	58.0
Leaking		14	82.0
Blockage		03	17.0
Hyperfluorescent vessels with leaking in later phases	NVD	04	23.0
	NVE	03	17.0
Salus sign		07	41.0
Gunn Sign		04	23.0
Total patients		17 patients	

**Discussion**

In Patients with diabetes and hypertension both, the severity of retinopathy was much more than in those having diabetes alone although the disease was present for the same duration in both of them. Presence of hypertension also increases the rate of development of retinopathy earlier than in those where hypertension was not present.

The possible mechanisms by which hypertension affects diabetic retinopathy are haemodynamic (impaired auto regulation and hyper perfusion) and secondly through VEGF (Vascular Endothelial Growth Factor).

Fluorescein angiography provides more information than what ophthalmoscopy with white light alone does. It enables us to plan and perform Laser photocoagulation in a precise manner.

It not only assess, but also help to quantify microvascular changes in a variety of retinal diseases. In patients with mild to moderate hypertension, an enlargement of the perifoveal intercapillary areas and a reduced capillary blood velocity was found.<sup>(9)</sup> However, for the severe stages of hypertensive retinopathy, the perifoveal microcirculation has not yet been quantified. Theoretically, a further decline in capillary density and capillary flow velocity would be expected.<sup>(10)</sup>

Changes in the luminal diameter of the arterioles are the most important component in regulating systemic arterial blood pressure.<sup>(11)</sup> The resistance of flow is equivalent to the fourth power of the diameter. Therefore, a 50% decrease in the lumen results in a 16-fold increase in the pressure.

Strict control of blood sugar and blood pressure, regular treatment, life style modification and follow up is necessary to retain good vision in patients of diabetes and hypertension.

## References

1. Ashton, N.: The eye in malignant hypertension. *Transac Am Acad Ophthalmol Otolaryngol.* 1972;76:17-40.
2. Kanski, Jack. *Clinical Ophthalmology.* 2014
3. Novotony, H.R. and Alvis, D.L.: A method of photographing fluorescence in circulating blood in human retina. *Circulation*, 1961,24:82-86.
4. Gass, J.D.M.: A fluorescein angiographic study of macular dysfunction secondary to retinal vascular disease III hypertensive retinopathy. *Arch Ophthalmol.* 1968;80:569-82.
5. WHO Tech Rep: Quoted from The 1980 report of Joint National Committee on detection evaluation and treatment of high blood pressure (1980). *Arch n Med.* 1978;140:1280-1285.
6. Richard, Gisbert "Fluorescein and ICG Angiography". THIEME 1998, ISBN.
7. Novtny HR, Alvis DL: A method of photographing fluorescence in circulating blood of the human eye (abstract). *Am J. Ophthalmol.* 50:176,1960.
8. Novtny HR, Alvis DL: A method of photographing fluorescence in circulating blood in the human retina. *Circulation* 24:82,1961.
9. Wolf S et al. Quantification of retinal capillary density and flow velocity inpatients with essential hypertension. *Hypertension.* 1994;23:464-467.
10. Schubert HD. Ocular manifestations of systemic hypertension. *Curr Opin Ophthalmol.* 1998;9:69-72.
11. Klein R, Klein BE, Moss SE. The relation of systemic hypertension to changes in the retinal vasculature: the beaver Dam Eye Study. *Trans Am Ophthalmol Soc.* 1997;95:329-348.