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Correlation of diabetic retinopathy with hypertension

Waris A[1], Ansari NN[2,*]

[1]Assistant Professor, [2]Junior Resident, Dept. of Ophthalmology, Jawaharlal Nehru Medical College & Hospital, Aligarh

***Corresponding Author:**
Email: ansarinada@gmail.com

Abstract

Diabetes mellitus is internationally on a pandemic. India is the diabetic capital of the world. With growing stress and life style changes hypertension too is on the rise. The same group of patients are afflicted by both the diseases. We tried to find any direct relation between diabetic retinopathy and hypertension. About 40% of patient suffering from DM are also hypertensive. The percentage is as high as 60% at 75 years of age.(1) The "United Kingdom Prospective Diabetes Study (UKPDS)" has successfully revealed the worsening of diabetic retinopathy with badly controlled hypertension.(1,2) The study strongly advocates that a tight control of blood pressure reduces the incidence of diabetic retinopathy to a great extent.(3,4)

Keywords: Diabetic retinopathy (DR), Diabetic mellitus (DM), Hypertension, Hyperglycemia

Introduction

Glucose toxicity is a key trigger for diabetic retinopathy. Diabetic retinopathy is due to microvascular ischemia. The endothelial cell dysfunction is multifactorial. An amalgamation of loss of pericytes, thickening of basement membrane, a break in the outer blood retinal barrier is the culprit. The role of cytokines, neuropathy and genetic factors are still in probe. The auto regulation capacity of retinal arterioles are unique to it and is adversely affected by hyperglycemia.(5,6) Systemic hypertension enhances the loss of auto regulation capacity of the arterioles which is already disrupted due to raised blood sugar. The rise of blood pressure of up to 40% can be regulated by the capillaries in non-diabetic patients.(7) Not only hypertension and hyperglycemia but impaired renal function, pregnancy, anemia, hyperlipidemia has a worsening effect on diabetic retinopathy. On the other hand carotid vessel arteriosclerosis, high myopia and glaucoma have interestingly a protective effect on diabetic retinopathy.(6) In this study of our thesis we are trying to find out the prevalence of diabetic retinopathy and if at all any relation exists with different grades of hypertension.

Materials and Methods

Ours is a cross-sectional study consisting of 30 patients with diabetic retinopathy who presented to the Retina Clinic, Institute of Ophthalmology and Rajiv Gandhi Center for Diabetes and Endocrinology, Jawaharlal Nehru Medical College, A.M.U., Aligarh.

Inclusion criteria:

- All diagnosed cases of diabetes mellitus with reasonably clear media being referred to the Retina Clinic, Institute of Ophthalmology, Jawaharlal Nehru Medical College and Hospital, AMU, Aligarh from Rajiv Gandhi Center for Diabetes and Endocrinology, of the same hospital.
- Age of the patient > 20 years.

Exclusion criteria

- The patients with media not clear (where fundus photography is not possible).
- The patients with gestational diabetes.
- The patients where fundus photography was not possible (in any particular eye or field) due to inadequate dilatation or an inability to co-operate, properly.

This cross-sectional study is being conducted after taking ethical clearance from Ethical Committee, Jawaharlal Nehru Medical College and Hospital, AMU, Aligarh. An informed written consent is being taken from each patient before participation in the study.

A clinical history is being taken with the help of a structured questionnaire including- demographic data, duration of diabetes, treatment taken, history of hypertension, addiction, dietary habit, family history of diabetes.

The laboratory profile of each patient would comprise of- blood sugar (both fasting (greater than or equal to 126mg/dL in diabetics) and two hour post-prandial (greater than or equal to 200mg/dL in diabetics), HbA_{1c} (greater than or equal to 6.5% in diabetics), renal function tests which include blood urea nitrogen (normal range: 7-20mg/dL) and serum creatinine (female, normal range: 0.5-0.9mg/dL and male, normal range: 0.6-1.2mg/dL).(32)

The ocular examination comprises of- refraction (undilated), slit lamp biomicroscopy as well as dilated fundoscopy with the use of 78D/90D Volk lens, direct ophthalmoscopy and indirect ophthalmoscopy. A fundus photograph using Visucam 500 is being taken and secured as an objective evidence of the subjective findings seen on 78D/90D slit lamp biomicroscopy and indirect ophthalmoscopy. The photos are graded against the standard photos of EDTRS grading system for the severity of retinopathy.

A diagnosis of diabetic retinopathy is being made when a patient exhibits a minimum of one

microaneurysm in any field, as well as hemorrhages (dot, blot or flame-shaped) and maculopathy (with or without clinically significant macular edema). The diagnosis of proliferative diabetic retinopathy will be made only if there is neovascularization. The ETDRS classification is being used to categorise the patients into various grades of diabetic retinopathy.

Results

Out of 30 patients with Diabetic Retinopathy, 4 patients had Mild NPDR, of which 1 (25%) had hypertension. Out of the 8 patients with Moderate NPDR, 3 (37.50%) had hypertension. Out of a total of 8 patients with severe NPDR, 4 (50%) patients had hypertension. Eight (80%) patients, out of a total of 10 patients of PDR group had hypertension. A total of 16 (53.33%) patients had hypertension.

Table 1

	with Hypertension	without Hypertension
Mild NPDR	1	3
Moderate NPDR	3	5
Severe NPDR	4	4
PDR	8	2
Total	16	14

Out of 30 patients with Diabetic Retinopathy, 4 patients had Mild NPDR, of which all four were unaffected by CSME. Out of the 8 patients with Moderate NPDR, all were unaffected. Out of a total of 8 patients with severe NPDR, 4 (50%) patients had CSME. Seven (70%) patients, out of a total of 10 patients of PDR group had CSME. A total of 11 (36.66%) patients had CSME.

Table 2

	with CSME	without CSME
Mild NPDR	0	4
Moderate NPDR	0	8
Severe NPDR	4	4
PDR	7	3
Total	11	19

Out of 30 patients with Diabetic Retinopathy, 4 patients had Mild NPDR, all of whom were unaffected. Out of the 8 patients with Moderate NPDR, all were unaffected. Out of a total of 8 patients with severe NPDR, 2 (25%) patients had impaired RFT. Eight (80%) patients, out of a total of 10 patients of PDR group had CSME. A total of 10 (33.33%) patients had impaired RFT.

Table 3

	with impaired RFT	without impaired RFT
Mild NPDR	0	4
Moderate NPDR	0	8
Severe NPDR	2	6
PDR	8	2
Total	10	20

These results show direct correlation between severity of both diseases which shall be statistically confirmed once our study is complete.

Discussion

As mentioned, diabetes and hypertension previously thought to be ailment of developed nation are now rampant in developing and poor countries also. In the "Wisconsin study" diabetic patients who had hypertension were defined by current antihypertensive treatment as a mean blood pressure >160/95 (or >140/90 in those under 25 years). The baseline prevalence of hypertension was 17.3%, and the 10 year incidence was 25.9%. As suggested by the "UKPDS study" 38% of newly diagnosed patients with type 2 DM had hypertension, which was defined as repeated blood pressure >160/90 (or>150/85 in patients on medication for hypertension.[9] The presence of microalbuminuria in about 80% of patients of type 1 DM before the diagnosis of hypertension suggests that renal damage (nephropathy) has a bigger impact on pathogenesis of hypertension.[10] On the contrary in cases of type 2 DM the effect is much less.[10] The other probable factors for worsening of hypertension in diabetic patients include reduced baroceptor sensitivity, enhanced peripheral vascular resistance from smooth muscle contractility, protein glycosylation and increased type IV collagen in the vessels.[11] The sodium retention and impaired glucose and electrolyte metabolism due to damaged convoluted tubules of the kidney is also attributed to hyperglycemia. We cannot undermine the effect of insulin resistance and hyperinsulinemia as a cause of hypertension in diabetics.

"The Reaven's syndrome" is an association of hyperinsulinemia, hypertension, hyperlipidaemia, obesity and insulin resistance in diabetes mellitus.[12]

The Treatment: When to start?

As per recommendation of "The World Health Organisation/ International Society of Hypertension 1999 guidelines suggests a systolic blood pressure criterion of >140 mm Hg and a diastolic blood pressure of > 90 mm Hg for definition of hypertension, and recommends that decision to treat should be based on cardiovascular risk assessment, using the Framingham equation".[13] The American Diabetes Society 2016 guidelines suggests a low target of blood pressure up to

130/80 for patients who are suffering from diabetes and cardiac patients.

"Joint British Societies' recommendations for treatment of hypertension in diabetes"

Type 1 diabetes:

Threshold: >130 systolic or >80 diastolic

Target: <130 systolic and <80 diastolic

<125 systolic and <75 diastolic if proteinuria

Type 2 diabetes:

Threshold: >160 systolic or >90 diastolic

>140 systolic or >90 diastolic if target organ damage, microvascular or macrovascular complications or absolute coronary risk >15% over 10 years

Target: <130 systolic and <80 diastolic

The target levels set by the *Joint British Societies' recommendations* for diabetes is challenging. As demonstrated by the "UKPDS" which found a requirement of three or more antihypertensive medications in 29% of the tight control group, and 60% needed at least dual antihypertensive therapy after 9 years of follow up.

Our study shows a high incidence of hypertension as the severity of diabetes retinopathy increases. Significantly again larger number of hypertensives were in patients with clinically significant macular edema group. Renal impairment is also directly associated with worsening of diabetic retinopathy. Our study is in lieu of most of the present studies.

Conclusion

Hence, we can conclude on basis of available literature, recommended studies and our own preliminary studies that there exist a unique relation between diabetes mellitus and hypertension which is statistically significant and directly proportional. We recommend a tight control of blood pressure, anemia, lipids and a healthy living in patients with diabetic retinopathy.

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