Original Article

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Effect of Blood Pressure in Progression of Diabetic Retinopathy

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Abstract

Objective: To analyze the role of blood pressure in predicting progression of diabetic retinopathy. *Materials and Methods*: This prospective clinical study was done on patients with diabetic retinopathy attending the OPD of department of Ophthalmology & those willing to participate this study. Sample size: 50 patients based on inclusion criteria will be registered, evaluated & followed up subsequently for 12 months. Inclusion criteria Patients with type I OR Type II diabetes who have diabetic retinopathy changes with or without macular edema (according to ETDRS classification). Exclusion criteria 1. Venous & arterial occlusion, post panretinal photocoagulation status, post anti-VEGF injection status, patients with posterior uveitis & glaucoma. 2. End stage patients who would not cooperate for fundoscopy. 3. Patients less than 18 years of age. *Results*: The increased risk of proliferative retinopathy was associated with the presence of hypertension at baseline. 43% of patients in moderate NPDR, 56% of severe group and 47% of very severe NPDR group were hypertensive. *Conclusion*: To conclude, in this study patients having hypertension are at high risk for progression and hence these patients should be followed up at frequent intervals and should be instituted appropriate treatment.

Keywords: Diabetes; Hypertension; Diabetic Retinopathy.

Introduction

Diabetes Mellitus is a heterogeneous group of metabolic diseases characterized by hyperglycaemia resulting from defects in insulin secretion, insulin resistance, or both. Diabetes is gaining the status of a potential epidemic in India with more than 62 million individuals currently diagnosed with the disease [1,2].

Among the ophthalmic complications are corneal abnormalities, pupillary abnormalities, iris neovascularisation, glaucoma, cataracts and retinopathy. However, the commonest ophthalmic complication remains diabetic retinopathy, although early retinopathy does not have a significant effect on vision, it can progress to a more advanced stage termed proliferative diabetic retinopathy. Due to the increasing incidence of diabetes, the burden of blindness caused by diabetic retinopathy is on the rise. Hence, newer modalities of diagnosis and treatment are also in evolution, with prime focus on early detection and halting the progression.

Prevalence of proliferative diabetic retinopathy & maculopathy was maximum in old age & patient with insulin treatment [3,4,5].

Hypertension aggravates the retinal ischemia caused by diabetic retinopathy. Both systolic and diastolic blood pressure contribute to retinal ischemia which is the central dogma for the retinopathy progression.

In this study, we record Blood pressure in patients with moderate and severe NPDR and observe them for progression during the follow up.

Multiple epidemiological studies have identified hypertension as a risk factor for diabetic retinopathy & diabetic macular edema.

In the UKPDS, tight blood pleasure control (defined as target BP (<150/85mmHg) in patients with type 2 diabetes reduced the rest of microvascular disease by 37% the rate of progression of diabetic retinopathy by 34% & the risk of deterioration of visual acuity by 47%.

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Materials and Methods

This prospective clinical study was done on patients with diabetic retinopathy attending the OPD of department of Ophthalmology & willing to participate this study.

Sample size:

50 patients based on inclusion criteria were registered, evaluated & followed up subsequently for 12 months.

Inclusion criteria:

Patients with type I OR Type II diabetes who have diabetic retinopathy changes with or without macular edema (according to ETDRS classification).

Exclusion criteria:

1. Venous & arterial occlusion, post panretinal photocoagulation status, post anti-VEGF injection status, patients with posterior uveitis & glaucoma.
2. End stage patients who would not cooperate for fundoscopy.
3. Patients less than 18 years of age.

Procedure

History

All patients were screened with a detailed history including type & duration of diabetes, diet history & history about physical activity. History of treatment with oral hypoglycemic agents, insulin & other drug intake was elicited. History of systemic comorbidities like hypertension, coronary artery disease etc & their treatment was enquired about. Previous ophthalmic surgery/laser or other medical treatment history was also taken.

All patients then underwent a thorough systemic & ocular examination.

General Examination

General vital data like pulse, systolic and diastolic blood pressure, peripheral pulses were noted. Systemic examination of CNS, CVS, RS and abdomen was done.

Ocular Examination

Visual acuity (by Snellen's chart) and refraction were measured. Anterior segment evaluation was done with slit lamp biomicroscopy. Intraocular pressure was measured using Applanation tonometry. Diabetic retinopathy was evaluated by a dilated fundus examination using 90D & indirect ophthalmoscopy.

Fundus photographs were taken for documentation and the levels of retinopathy was then classified as per the ETDRS.

A through eye examination by standardised methods was carried out. It includes:

1. Measurement of best corrected visual acuity.
2. Examination of the anterior segment of the eye with a slit lamp biomicroscopy.
3. Fundus examination with direct & indirect ophthalmoscopy & 90D lens through the dilated pupil.
4. Measurement of intraocular pressure.
5. Fundus fluorescein angiography.

Follow up Visits

Every month. During follow up visits - Fasting blood sugar levels, post prandial blood sugar,blood pressure, visual acuity, intraocular pressure, slit lamp biomicroscopy (anterior segment & fundus with +90D), and ophthalmoscopy was done. Any progression of diabetic retinopathy was documented.

Results

Systolic Blood Pressure

In this study, 48% of the patients had their systolic blood pressure in the range of 120-139mmHg, 34% in the range of 140-159mmHg, 16% had their systolic BP<120mmHg and the remaining 2% had BP>160mmHg.

The mean systolic BP was 135.77±16.60 mm of Hg.

Systolic Blood Pressure Vs Baseline Retinopathy

The mean systolic blood pressure in moderate, severe and very severe NPDR were 121.71±13.21, 141.17±15.78, 139.72±13.94 mm of Hg respectively.

Table 1: Systolic Blood Pressure

SBP (mm of Hg)	< 120	120 - 139	140 - 159	≥ 160	TOTAL
No. of Patients	8	24	17	1	50
%	36	48	34	2	100

SBP- Systolic blood pressure.

Table 2: Diastolic Blood Pressure

DBP	No. of Patients	Percentage
< 80	6	12
80 - 89	23	46
90 - 99	19	38
> = 100	2	4
TOTAL	50	100

DBP- Diastolic blood pressure

Diastolic BP Vs Baseline Retinopathy

Table 3: Diastolic BP Vs Baseline Retinopathy

BR in BE	DBP (mm of Hg)									
	< 80	%	80 - 89	%	90 - 99	%	≥100	%	TOTAL	%
Mod NPDR	3	6	8	16	3	6	0	0	14	28
Severe NPDR	2	4	6	12	9	18	1	2	18	36
Very Severe NPDR	1	2	9	18	7	14	1	2	18	36
Total	6	12	23	46	19	38	2	4	50	100

BR- baseline retinopathy, DBP- diastolic blood pressure.

Progression of DR BE

Table 4: Progression of DR BE

Progression of DR BE	No. of Patients	Percentage
Yes	23	46
No	27	54
Total	50	100

DR BE- diabetic retinopathy in both eye.

Baseline Retinopathy Vs Retinopathy at the end BE

Table 5: Baseline Retinopathy Vs Retinopathy at the end BE

BR	Retinopathy at end BE									
	MOD NPDR	%	SEV NPDR	%	VERY SEV NPDR	%	PDR	%	total	%
MOD NPDR	10	20	4	8	0	0	0	0	14	28
SEV NPDR	1	2	9	18	8	16	0	0	18	36
VERY SEV NPDR	0	0	0	0	9	18	9	18	18	36
Total	11	22	13	26	17	34	9	18	50	100

BR- Baseline retinopathy, MOD NPDR- moderate non progressive diabetic retinopathy, SEV NPDR- severe non progressive diabetic retinopathy, BE-both eyes

Diastolic Blood Pressure

The mean diastolic BP was 83.4±7.60 mm of Hg.

Around 54% of the patients participated in the study did not progress to next stage of diabetic retinopathy. The remaining 46% progressed to next level of diabetic retinopathy. In this study, 81% of the patients with systolic BP <140 did not progress whereas 43% of the patients progressed. Around 18% of patients with systolic BP >140 did not progress while 56% of patients showed progression. The mean systolic BP in those who progressed and who did not progress were 143.09± 12.20 and 128.48±16.91 mm of Hg respectively. p value determined by the two tiled chi-square test was 0.005 which was <0.05 meaning that it was statistically significant.

In this study, 62% of patients with diastolic BP <90 did not show progression whereas 38% progressed. About 56% of the patients with diastolic >90 BP progressed to next stage of retinopathy while 44% of the patients did not progress. The mean diastolic BP in patients who showed progression was 86.09±6.56 mm of Hg and that in patients who did not progress was 81.11±7.51 mm. p value was found to be 0.013 which was > 0.05 meaning statistically significant.

About 71% of patients diagnosed as Moderate NPDR in BE at Baseline remained the same at the end while the remaining 22% progressed to severe NPDR. Among patients who were diagnosed to have severe NPDR at baseline, 44% progressed to very severe stage and the remaining 50% remained in the severe NPDR stage. Around 50% of patients who had Very severe NPDR at the beginning of the study progressed to Proliferative diabetic retinopathy and 50% had very severe NPDR.

Discussion

Diabetic retinopathy is one of the potentially blinding condition in middle age and elderly patients. Among the various factors that can influence the progression of diabetic retinopathy, the impact of blood pressure are discussed in this study.

The increased risk of proliferative retinopathy was associated with the presence of hypertension at baseline. 43% of patients in moderate NPDR, 56% of severe group and 47% of very severe NPDR group were hypertensive. Around 11% of severe group and 28% of very severe NPDR group had nephropathy at baseline. 17% of severe group and 17% of very severe NPDR group had coronary artery disease. 2 patient in moderate NPDR group had a previous attack of stroke.

In this study, 48% of the patients had their systolic blood pressure in the range of 120-139mm of Hg, 34% of the patients had their systolic BP in range of 140-159mm of Hg, 16% had their systolic BP <120 mm of Hg and the remaining 2% had BP>160 mm of Hg. The mean systolic BP was 135.77±16.60 mm of Hg. The UKPDS showed that the incidence of retinopathy was associated with systolic blood pressure.

The mean systolic blood pressure in moderate, severe and very severe NPDR were 121.71±13.21, 141.17±15.78, 139.72±13.94 mm of Hg respectively. About 50% of the patients with moderate NPDR had their systolic BP in the range of 120-139 mm of Hg, 43% of the patients fell in the <120 mm of Hg group and remaining 7% had 140-159 mm of Hg.. in the severe NPDR group, 50% of the patients had systolic BP in the range of 120-139 mm of Hg, 39% of the patient's systolic BP was in the range of 140-159 mm of Hg, 6% in <120 mm of Hg group and the remaining 6% in 60 mm of Hg group. In very severe NPDR category, 50% of the patients fell in the 140-159 mm of Hg group, 44% had their systolic BP in the range of 120-139 mm of Hg and 6% fell in <120 mm of Hg group.

In this study, around 46% of patients had diastolic BP in range of 80-89mm of Hg followed by 38% in 90-99 mm of Hg, 12% in <80 mm of Hg and 4% in ≥ 100 mm of Hg. The mean diastolic BP was 83.4±7.60 mm of Hg.

The mean diastolic blood pressure in moderate, severe and very severe NPDR was 80±6.79 mm of Hg, 85±7.86 mm of Hg and 84.44±7.05 mm of Hg respectively. In the moderate NPDR group, 57% of the patients had diastolic BP in the range of 80-89 mm of Hg, 17% of the patient's diastolic BP was < 80 mm of Hg and 17% in the range of 90-99 mm of Hg group. About 50% of the patients with severe NPDR had their diastolic BP in the range of 90-99 mm of Hg, 11% of the patients fell in the <80 mm of Hg group, another 33% of patients fell in the 80-89 mm of Hg and the remaining 6% had their diastolic BP > 100 mm of Hg. In very severe NPDR category, 50% of the patients fell in the 80-89 mm of Hg group, 39% had their systolic BP in the range of 90-99 mm of Hg, 6% fell in <80 mm of Hg group and remaining 6% had diastolic BP >100 mm of Hg.

A 34% reduction in risk of deterioration of retinopathy was achieved by a tight control of blood pressure in the UKPD Study [6].

In the Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR), diastolic blood pressure was a significant predictor of progression of diabetic retinopathy to proliferative diabetic retinopathy over 14 years of follow up in patients with younger onset (type 1) diabetes mellitus, independent of glycosylated haemoglobin and the presence of gross proteinuria. However, neither systolic or diastolic blood pressure nor hypertension at baseline were associated with the incidence and progression of retinopathy in people with type 2 diabetes mellitus

In this study, 81% of the patients with systolic BP <140 did not progress whereas 43% of the patients progressed. Around 18% of patients with systolic BP >140 did not progress while 56% of patients showed progression. The mean systolic BP in those who progressed and who did not progress were 143.09± 12.20 and 128.48±16.91 mm of Hg respectively. p value determined by the two tiled chi-square test was 0.005 which was <0.05 meaning that it was statistically significant. In "Glycemic Exposure and Blood Pressure Influencing Progression and Remission of Diabetic Retinopathy study", SBP was also a significant risk factor for progression to mild BDR from the initial retinopathy-free state and the reduction in SBP by 1 SD (17.28 mmHg) was associated with a 20% increased chance of regression back to the retinopathy-free state.

The study shows that 62% of patients with diastolic BP <90 did not show progression whereas 38% progressed. About 56% of the patients with diastolic BP >90 progressed to next stage of retinopathy while 44% of the patients did not progress. The mean diastolic BP in patients who showed progression was 86.09±6.56 mm of Hg and that in patients who did not progress was 81.11 ±7.51 mm. p value was found to be 0.013 which was > 0.05 meaning statistically significant.

Summary

Around 50 patients with type 2 diabetes mellitus and non proliferative diabetic retinopathy were included in this study in the OPD of department of ophthalmology over a period of 12 months.

The aim was to analyze the factors like glycemic status and blood pressure in predicting progression of diabetic retinopathy.

50 patients were enrolled in the study based on the selection criteria, baseline parameters documented and followed up to look for progression of diabetic retinopathy.

The mean systolic blood pressure in moderate, severe and very severe NPDR were 121.71±13.21, 141.17±15.78, 139.72±13.94 mm of Hg respectively. The mean diastolic blood pressure in moderate, severe and very severe NPDR was 80±6.79 mm of Hg, 85.44±.86 mm of Hg and 84.44±7.05 mm of Hg respectively.

In this study, 81% of the patients with systolic BP <140 did not progress whereas 43% of the patients progressed. Around 18% of patients with systolic BP ≥140 did not progress while 56% of patients showed progression. p value determined was 0.005 which was <0.05 meaning that it was statistically significant.

In this study, 74% of patients with diastolic BP <90 did not show progression whereas 39% progressed. About 61% of the patients with diastolic BP > 90 progressed to next stage of retinopathy while 26% of the patients did not progress. p value was found to be 0.013 which was >0.05 meaning statistically not significant.

Conclusion

To conclude, this study Patients having hypertension are at high risk for progression of diabetic retinopathy and hence these patients should be followed up at frequent intervals and should be instituted appropriate treatment.

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