



## Association of blood pressure with diabetic retinopathy and its severity in patients of type-II diabetes.

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**ABSTRACT... Objective:** To identify the association of blood pressure with DR and its severity in type two diabetics. **Study Design:** Descriptive, Correlational study. **Setting:** Outpatient Department of Layton Rahmatulla Benevolent Trust Eye Hospital, Lahore. **Period:** 1<sup>st</sup> July, 2016 to 30<sup>th</sup> August, 2016. **Materials & Method:** After recording of demographic data, 80 type two diabetics of age 45-65 years of both genders were evaluated by consultant ophthalmologist for status and grading of diabetic retinopathy. Blood pressure was recorded with the help of mercury sphygmomanometer. Data were entered and analyzed on SPSS version 22. Qualitative variables were mentioned as percentages. For comparison of quantitative variables, student "t" test or mann whitney U test as per distribution of data, were applied. For exploring the association between blood pressure and diabetic retinopathy, spearman rho correlation test was employed. **Results:** Out of total 80 patients, 42 had DR of varying grade. Most of the study participants were females (62.5 %). On comparison between two groups, systolic blood pressure was not significantly different however, diastolic blood pressure had significant difference. Both systolic and diastolic blood pressure had significant association with severity of DR in both eyes of the patients with only exception of diastolic blood pressure with severity in left eye, which had non-significant correlation. **Conclusion:** The study results suggest that, blood pressure should be considered as a contributing factor for development and progression of diabetic retinopathy.

**Key words:** Diabetes Mellitus, Diabetic Retinopathy, Morbidity.

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### INTRODUCTION

In Pakistan, type-two diabetes mellitus (T2DM) is among the frequently occurring disorders.<sup>1</sup> According to WHO, as per prevalence of diabetes mellitus, Pakistan is at the position 8 in the world and is estimated to be at position 4 by the year 2025.<sup>2</sup> Chronic hyperglycemia in T2DM leads to micro and macrovascular complications and consequently responsible for morbidity and mortality of disease. Diabetic retinopathy (DR) is one of the deadly microvascular complication due to its threat to vision. One of the prominent reasons of loss of vision in the working age group of 30-70 years is DR.<sup>1</sup>

Type two diabetics having prolong duration of diabetes, elevated blood pressure and poor glycemic control are more prone to develop microvascular complications.<sup>3</sup> It has been

suggested that high blood pressure leads to increased retinal blood flow with consequent shear damage to retinal endothelial cells. This mechanism has been supported by various cross-sectional studies but longitudinal studies do not support the association of high blood pressure and diabetic retinopathy.<sup>4</sup> The UKPDS showed that the DR prevalence was significantly associated with systolic blood pressure.<sup>5</sup> In the Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR), diastolic blood pressure was a significant predictor of progression of diabetic retinopathy to severe form.<sup>6</sup> Almost 75% of type two diabetics develop hypertension. Lowering of blood pressure in hypertensive diabetics has its obvious beneficial vascular effects. Lowering of blood pressures already in the normal range is beneficial in stopping progression of DR, is still unknown.<sup>4</sup>

Challenge of better and advanced understanding of the role of abnormal blood pressure in the pathogenesis of diabetic retinopathy provides an avenue and opportunity to Health care providers to expand and improve care of their patients.

The aim of this study is to explore the relationship of blood pressure with diabetic retinopathy and its severity in local type two diabetics with consequent utilization of data aiming for improving quality of life of diabetic patients.

## MATERIALS & METHODS

In this cross-sectional case control study, 80 patients of both gender with type two diabetes were enrolled after informed consent in written from the outpatient department of Layton Rahmatulla Benevolent Trust Eye Hospital, Lahore. Important demographic information was recorded in Performa. Each patient was evaluated for the presence or absence and staging/grading<sup>7</sup> of diabetic retinopathy (DR) by consultant ophthalmologist through indirect ophthalmoscopy with the help of Superfield 90D lens. Patients were organized in two groups i.e., diabetics with DR and without DR.

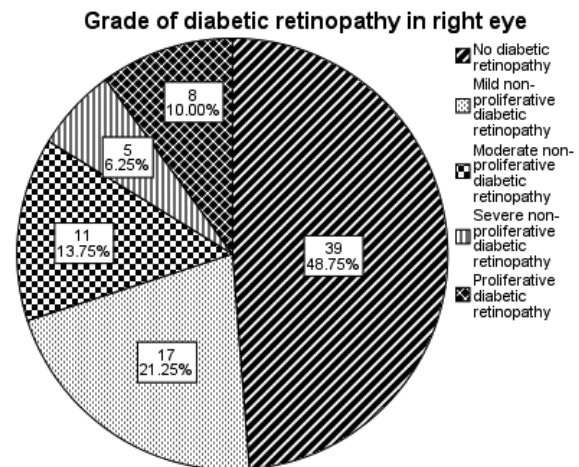
For blood pressure recording by indirect method with the help of mercury sphygmomanometer, the patient was made to sit in a comfortable chair with the back supported and the one arm held at heart level supported on a table with slightly flexed elbow and bared without constrictive clothing. The cuff of sphygmomanometers was applied at upper arm 2-3 cm above the cubital fossa after palpating for brachial artery and encircled almost 80% of the circumference of arm. Before recording of blood pressure subjects were made to relax at least for five minutes. The chest piece of stethoscope was placed at the midpoint of cubital fossa. The mercury column was deflated at 2 to 3 mm of Hg and then cuff was inflated. Upon deflation the first and last audible sounds were recorded and these were considered values of systolic and diastolic pressure respectively. The column was read to the nearest 2 mm Hg.<sup>8</sup> (Pickering et al., 2005).

Obtained data were entered and analyzed on

IBM SPSS for Windows software (version 22). Frequencies and percentages were mentioned for gender distribution and DR severity distribution. Mean  $\pm$  SD or median  $\pm$  interquartile range (depending upon normality or non-normality of data determined by Shapiro-Wilk test) were given for blood pressure readings. Depending on the data normality (Shapiro-Wilk), either Independent "t" Test or Mann-Whitney U tests for comparison of quantitative data were applied. p 0.05 was considered statistically significant. Association of systolic and diastolic blood pressure with severity of diabetic retinopathy was checked by spearman rho correlation.

## RESULTS

In this study, total 80 patients between the age 45-65 years with type two diabetes were involved. Further stratification was done on the basis of presence and absence of diabetic retinopathy. Forty-two patients were type two diabetics having diabetic retinopathy of varying grade (Figure-1 & 2), while thirty-eight were those diabetics who did not have diabetic retinopathy.



**Figure-1. Graphical representation of grade of diabetic retinopathy in right eye.**

Gender distribution in both groups is given in Table-I. Mean systolic blood pressure was 135.71  $\pm$  21.20 mm of Hg in diabetic retinopathy group (Table-II), while median (IQR) systolic blood pressure was 120.00 (110.00-140.00) mm of Hg in non-diabetic retinopathy group (Table-II). When systolic blood pressure was compared with Mann-Whitney U test, non-significance difference was

seen (p=0.06; Table-III).

Median (IQR) diastolic blood pressure was 80.00 (70.00-90.00) mm of Hg and 80.00 (67.50-80.00) mm of Hg in diabetic retinopathy group (Table-II) and non-diabetic retinopathy group respectively (Table-II) with a significant difference between them as seen by Maan whitney U test (p=0.04; Table-III).

Correlation of grades of DR were statistically analyzed of all 80 diabetic individuals irrespective of retinopathy because severity of DR was graded on the basis of severity scale by Wilkinson et al. (2003).<sup>7</sup> According to this scale zero score was assigned to the eye without DR and maximum score four was assigned to the eye with the most severe form of DR i.e., proliferative diabetic retinopathy. Hence, all the individuals included in this study were analyzed uniformly. After statistical analysis of all 80 type-2-diabetic individuals irrespective of retinopathy.

Systolic blood pressure showed significant and positive correlation with severity of DR in both eyes. While diastolic Blood pressure is significantly correlated in individuals having diabetic retinopathy in right eye. (Table-IV).

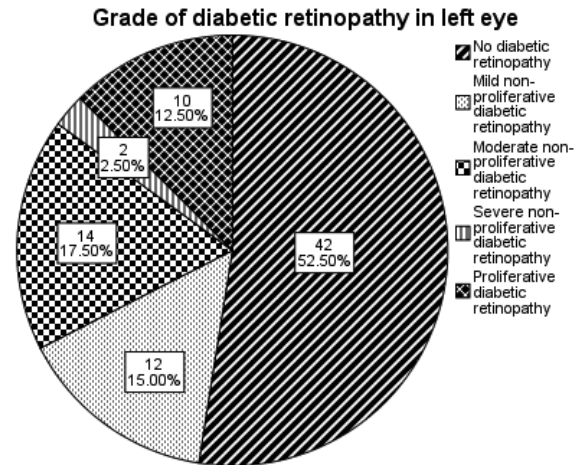


Figure-2. Graphical representation of grade of diabetic retinopathy in left eye.

			Study Groups		Total
			Type 2 diabetics with diabetic retinopathy	Type 2 diabetics without diabetic retinopathy	
Gender	Male	Count	17	13	30
		% within group	40.5%	34.2%	37.5%
	Female	Count	25	25	50
		% within group	59.5%	65.8%	62.5%
Total	Count	42	38	80	
	% within group	100.0%	100.0%	100.0%	

Table-I. Gender count relationship between type 2 diabetics with and without retinopathy. (\*Shapiro- Wilk test)

Quantitative Parameters	Type 2 diabetics with diabetic retinopathy n=42			
	Mean ± SD	Median (IQR)	*Distribution	P-Value
Systolic blood pressure (mm of Hg)	135.71 ±21.20	130.00 (120.00-150.00)	Normal	0.133
Diastolic blood pressure (mm of Hg)	80.60 ±10.60	80.0 (70.00-90.00)	Non Normal	0.007
Quantitative Parameters	Type 2 diabetics without diabetic retinopathy n=38			
Systolic blood pressure (mm of Hg)	126.84 ±21.44	120.00 (110.00-140.00)	Non Normal	0.001
Diastolic blood pressure (mm of Hg)	75.53 ±11.31	80.00 (67.50-80.00)	Non Normal	0.002

Table-II. Descriptive analysis of quantitative variables of type two diabetics with and without diabetic retinopathy

Parameters	Type 2 diabetics with diabetic retinopathy n=42	Type 2 diabetics without diabetic retinopathy n=38	P-Value
	Mean $\pm$ SD	Mean $\pm$ SD	
	Median(IQR)	Median(IQR)	
Systolic Blood Pressure (mm of Hg)	135.71 $\pm$ 21.20	126.84 $\pm$ 21.44	0.067 <sup>b</sup>
	130.00 (120.00-150.00)	120.00 (110.00-140.00)	
Systolic Blood Pressure (mm of Hg)	80.60 $\pm$ 10.60	75.53 $\pm$ 11.31	0.042 <sup>ab</sup>
	80.00 (70.00-90.00)	80.00 (67.50-80.00)	

**Table-III. Comparison of study variables in Type 2 diabetics (T2DM) with and without diabetic retinopathy (DR)**

<sup>a</sup>p value is generated by student t-test

<sup>b</sup>p value is generated by Maan Whitney U test

\*p-value  $\leq$  0.05 is considered statistically significant

Correlation of grade of diabetic retinopathy	Right Eye		Left Eye	
	Spearman's rho correlation coefficient	p-value*	Spearman's rho correlation coefficient	p-value*
Systolic blood pressure (mm of Hg)	0.337	0.002*	0.230	0.040*
Diastolic blood pressure (mm of Hg)	0.269	0.016*	0.182	0.106

**Table-IV. Correlation of severity of retinopathy with quantitative variables in type 2 diabetics patients n=80**

\*p-value  $\leq$  0.05 is considered statistically significant

## DISCUSSION

In this study we explored the relationship between blood pressure (systolic and diastolic blood pressure) and diabetic retinopathy and also analyzed the association of blood pressure with the severity of DR.

In our study, diabetic retinopathy group had slightly higher values as compared to non-diabetic retinopathy group. When systolic blood pressures and diastolic blood pressures of patients were compared between diabetic retinopathy and non-diabetic retinopathy group, it was seen that systolic blood pressure ( $p=0.067$ ) has no significant difference between the two groups while diastolic blood pressure were significantly different ( $p=0.042$ ). Study done by Jeon et al. (2016) reported no significant difference both in systolic and diastolic blood pressure in type two diabetics with and without diabetic retinopathy.<sup>9</sup> Though we could not validate a significant difference of systolic blood pressure however the diabetic retinopathy group has higher values of systolic blood pressure.

U.K. Prospective Diabetes Study Hypertension in diabetes study ((UKPDS-HDS) has suggested

that good control of blood pressure can result in reduction of microvascular complications to 37%.<sup>10</sup> The desirable value of diastolic pressure below 80 mm of Hg and systolic pressure below 130 mm of Hg has proposed by same study to minimize the vascular risk.<sup>11</sup> The mean/median systolic and diastolic blood pressure of our both study group were in conation with suggested values supporting the role of good blood pressure control in DR.

A strong linkage of severity of diabetic retinopathy and hypertension has been supported by many studies.<sup>12</sup> Similarly, diabetic retinopathy was shown to strongly associated with duration of diabetes, high levels of HbA1c and presence of hypertension.<sup>13,14</sup> Van Leiden et al. studied various risk factors of DR and reported the significant correlation of DR with systolic and diastolic hypertension.<sup>15</sup> We also found significant correlation between severity of DR in both eyes with the systolic and of only right eye with the diastolic blood pressure. Further studies with much bigger sample size and better research protocol are needed to be define the role of BP in DR.

## CONCLUSION

Though this study could not establish a very explicit evidence of association of blood pressure (systolic and diastolic) with diabetic retinopathy, yet, blood pressure was found to be significantly associated with severity of diabetic retinopathy. Thus, it can be stated that lowering of blood pressure can be beneficial for other related problems, however considering high blood pressure solely responsible for development of diabetic retinopathy is not strongly evident in our study. Furthermore, association of blood pressure with severity of diabetic retinopathy points towards possible relation between them.

## RECOMMENDATIONS

Further studies at larger scale aiming at evaluating the role of blood pressure in pathogenesis and progression of DR would be cost effective.




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### AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Kanwal Ijaz	Data collection, Analysis & interpretation of data, Drafting of article.	
2	M. Luqman Ali Bahoo	Concept & design of study.	
3	Beenish Karamat	Literature review.	
4	Asia Aziz	Critical review of article.	