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The Association between Retinal Vein Occlusion and Axial Length of Eyeball

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Abstract **Original Research Article**

Background: According to study, Retinal vein occlusion (RVO) is the second most common retinal vasculopathy after diabetic retinopathy, which causes permanent visual loss. ***Objective:*** In this study our main goal is to assess the association between retinal vein occlusion and axial length of eyeball. ***Method:*** This cross sectional study was carried out at Department of Ophthalmology, Bangabandhu Sheikh Mujib Medical University, Shahbagh, Dhaka from From March 2016 to March 2019. Where 60 Patients who were attending in the Department of Ophthalmology, BSMMU was the population of the study. During the study, 30 patients with retinal vein occlusion are included in Group A whereas remaining patients with no refractive error and no RVO are included in Group B. ***Results*:** During the study, in both group majority of the cases belong to 41-50 years age group whereas 17(56.7%) patients were male in group A and 12(40.0%) in group B. Fourteen (43.3%) patients were female in group A and 18(60.0%) in group B.In group A, 17(56.7%) patients were affected in left eye, 11(36.7%) in right eye and 2(6.7%) in bilateral eyes. Eighteen (60.0%) patients were found affected with BRVO and 12(40.0%) with CRVO. Whereas Mean axial length of eyeball was found 22.81±0.67 mm in affected eyes of group A and 23.38±0.92 mm in eyes of group B. The mean axial length of eyeball was found 22.82±0.78 mm in fellow eyes of group A and 23.38±0.92 mm in eyes of group B. Besides that, mean axial length of eyeball was found 22.69±0.54 mm in affected eyes of BRVO and 23.38±0.92 mm in eyes of group B. The mean axial length of eyeball was found 22.70±0.71 mm in fellow eyes of BRVO and 23.38±0.92 mm in eyes of group B. The differences were statistically significant ($p<0.05$)**.** ***Conclusion:*** On the basis of the findings in this study, it may be surmised that shorter axial length may be a local risk factor for developing RVO.

Keywords: Retinal vein occlusion (RVO), Branch Retinal Vein Occlusion (BRVO), Central Retinal Vein Occlusion (CRVO) and hemi-CRVO.

INTRODUCTION

Retinal vein occlusion (RVO) is the second most common retinal vasculopathy after diabetic retinopathy, which results in permanent visual loss. There are a variety of factors that can disturb ocular circulation and so cause retinal vein occlusion [1].

The most recognized risk factors for RVO are the senility and accompanying systemic vascular diseases [2]. Hayreh has divided RVO into three types: Branch Retinal Vein Occlusion (BRVO), Central Retinal Vein Occlusion (CRVO) and hemi-CRVO [3].

The prevalence of RVO in USA, Europe, Asia and Australia is 5.20 per 1000 for any RVO, 4.42 per 1000 for BRVO and 0.80 per 1000 for CRVO [4].

This shows that BRVO is 4 times more common than CRVO. The Beaver Dam Eye Study reported a 5-year cumulative incidence of central retinal vein occlusion (CRVO) is 0.1-0.2%. For a branch retinal vein occlusion (BRVO) this was approximately three times more at 0.6% [5]. The overall prevalence of any RVO (central or branch) in Asian population is 0.7% [6].

Moreover, the main components that comprise the refractive power of the eye include the dioptric power of the cornea and lens, the anterior chamber depth and the axial length of eyeball. Hyperopia is not the primary result of shorter axial length; the correlation between the variables is small, except in extreme refractive errors [7]. However, some studies suggest that there is an association between axial length of eyeball and retinal vein occlusion [8].

OBJECTIVE

- To assess the association between retinal vein occlusion and axial length of eyeball.

METHODOLOGY

This cross sectional study was carried out at Department of Ophthalmology, Bangabandhu Sheikh Mujib Medical University, Shahbagh, Dhaka from From March 2016 to March 2019. Where 60 Patients who were attending in the Department of Ophthalmology, BSMMU was the population of the study. During the study, 30 patients with retinal vein occlusion are included in Group A whereas remaining patients with no refractive error and no RVO are included in Group B. In addition those who had history of previous intraocular surgery were excluded from the study.

Method

The purposive sampling technique was applied to collect sample from the study population, as per inclusion and exclusion criteria.

Complete clinical evaluation of every patient including history, physical examination, relevant ocular examinations, fundus examination, IOP were done in the department of Ophthalmology, Bangabandhu Sheikh Mujib Medical University. During the study, the demographic information, relevant history, clinical examination findings, ocular examination findings, IOP, fundus examination of all the study subjects were recorded in the data collection sheet.

STATISTICAL ANALYSIS

Statistical analysis was carried out by using the Statistical Package for Social Sciences version 23.0 for Windows (SPSS Inc., Chicago, Illinois, USA). The mean values were calculated for continuous variables. The quantitative observations were indicated by frequencies and percentages. Chi-Square test was used to analyze the categorical variables, shown with cross tabulation. Student t-test was used for continuous variables. P values <0.05 was considered as statistically significant.

RESULTS

In table-1 shows age distribution of the study population where in both group majorities of the cases belong to 41-50 years age group.

The mean age was found 45.3±8.0 years in group A and 42.1±5.0 years in group B. The difference was not statistically significant (p>0.05) between two groups. The following table is given below in detail:

Table-1: Distribution of study population by age (n=60)

Age (years)	Group A (n=30)		Group B (n=30)		P value
	n	%	n	%	
31-40	11	36.7	14	46.7	0.069^{ns}
41-50	11	36.7	16	53.3	
51-60	8	26.7	0	0.0	
Mean±SD	45.3	±8.0	42.1	±5.0	
Range(min-max)	32	-60	31	-50	

Ns= not significant
P value reached from unpaired t-test

In figure-1 shows gender distribution of the study group where 17(56.7%) patients were male in group A and 12(40.0%) in group B. Fourteen (43.3%) patients were female in group A and 18(60.0%) in group B. The difference was not statistically significant (p>0.05) between two groups. The following figure is given below in detail:

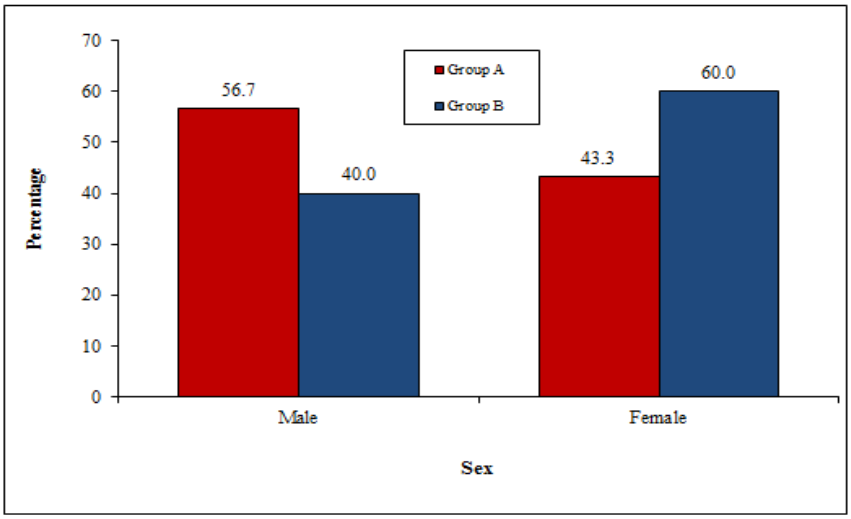

Fig-1: Gender distribution of study population (n=60)

P = 0.196

P value reached from chi square test

In table-2 shows Distribution of study population according to past clinical history. In past history, 18(60.0%) patients had diabetes in group A and 13(43.3%) in group B. Sixteen (53.3%) patients had hypertension in group A and 10(33.3%) in group B. Four (13.3%) patients had other diseases in group A and not found in group B. The differences were not statistically significant (p>0.05) between two groups. The following table is given below in detail:

Table-2: Distribution of study population according to past clinical history (n=60)

Past history	Group A (n=30)		Group B (n=30)		P value
	n	%	n	%	
Diabetes	18	60.0	13	43.3	0.196^{ns}
Hypertension	16	53.3	10	33.3	0.118^{ns}
Others	4	13.3	0	0.0	0.056^{ns}

ns= not significant

P value reached from chi square test

In table-3 shows smoking status where 13(43.3%) patients were smoker in group A and 8(26.7%) in group B. The difference was not statistically significant (p>0.05) between two groups. The following table is given below in detail:

Table-3: Distribution of study population according to history of smoking (n=60)

Smoker	Group A (n=30)		Group B (n=30)		P value
	n	%	n	%	
Yes	13	43.3	8	26.7	0.176^{ns}
No	17	56.7	22	73.3	

ns= not significant

P value reached from chi square test

In table-4 shows family history of study group where 23(76.7%) patients had family history of diabetes in group A and 10(33.3%) in group B. Twenty four (80.0%) patients had family history of hypertension in group A and 1(3.3%) in group B. Eight (26.7%) patients had family history of other disease in group A and 1(3.3%) in group B, which were statistically significant (p<0.05) between two groups. The following table is given below in detail:

Table-4: Distribution of study population according to family history (n=60)

Family history	Group A (n=30)		Group B (n=30)		P value
	n	%	n	%	
Diabetes	23	76.7	10	33.3	0.001[s]
Hypertension	24	80.0	1	3.3	0.001[s]
Others	8	26.7	1	3.3	0.013[s]

s= significant

P value reached from chi square test

In table-5 shows the study group-A distribution according to types of RVO where in group A, 17(56.7%) patients were affected in left eye, 11(36.7%) in right eye and 2(6.7%) in bilateral eyes. Eighteen (60.0%) patients were found affected with BRVO and 12(40.0%) with CRVO. The following table is given below in detail:

Table-5: Distribution of study population according to types of RVO in group A (n=30)

Ocular examination	Number of patients	Percentage
Side		
Left	17	56.7
Right	11	36.7
Bilateral	2	6.7
Type of RVO		
BRVO	18	60.0
CRVO	12	40.0

In figure-2 shows refractive status of study population in group A. In group A, 15(50.0%) patients were hypermetropic, 14(46.7%) were myopic and 1(3.3%) was with no refractive error. The following figure is given below in detail:

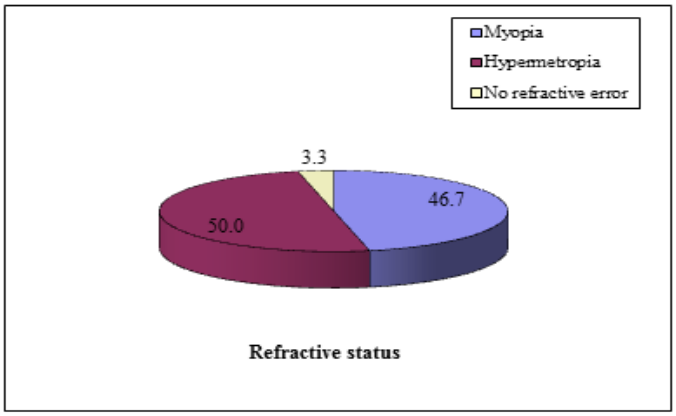

Fig-2: Refractive status of study population in group A

In table-6 shows comparison between axial length of eyeball in affected and fellow eyes of group A with eyes of group B. Mean axial length of eyeball was found 22.81±0.67 mm in affected eyes of group A and 23.38±0.92 mm in eyes of group B. The mean axial length of eyeball was found 22.82±0.78 mm in fellow eyes of group A and 23.38±0.92 mm in eyes of group B. The differences were statistically significant ($p<0.05$) between two groups. The following table is given below in detail:

Table-6: Comparison between axial length of eyeball in affected and fellow eyes of group A with eyes of group B

	n	Axial length of eyeball (mm)				P value
		Mean	±SD	Min	-max	
Affected eyes	30	22.81	±0.67	21.24	-24.96	0.009[s]
Group B eyes	30	23.38	±0.92	21.92	-25.05	
Fellow eyes	28	22.82	±0.78	21.07	-24.92	0.015[s]
Group B eyes	30	23.38	±0.92	21.92	-25.05	

s= significant

P value reached from unpaired t-test

In table-7 shows comparison between axial length of eyeball in affected and fellow eyes in CRVO patients of group A with eyes of group B.

Mean axial length of eyeball was found 22.98±0.82 mm in affected eyes of CRVO and 23.38±0.92 mm in eyes of group B. The mean axial length of eyeball was found 22.96±0.88 mm in fellow eyes of CRVO and 23.38±0.92 mm in eyes of group B. The differences were not statistically significant (p>0.05) between two groups. The following table is given below in detail:

Table-7: Comparison between axial length of eyeball in affected and fellow eyes in CRVO patients of group A with eyes of group B

	n	Axial length of eyeball (mm)				P value
		Mean	±SD	Min	-max	
Affected eyes	12	22.98	±0.82	22.0	-24.96	0.198[ns]
Group B eyes	30	23.38	±0.92	21.92	-25.05	
Fellow eyes	12	22.96	±0.88	21.44	-24.92	0.184[ns]
Group B eyes	30	23.38	±0.92	21.92	-25.05	

ns= not significant

P value reached from unpaired t-test

In table-8 shows comparison between axial length of eyeball in affected and fellow eyes in BRVO patients of group A with eyes of group B.

Mean axial length of eyeball was found 22.69±0.54 mm in affected eyes of BRVO and 23.38±0.92 mm in eyes of group B. The mean axial length of eyeball was found 22.70±0.71 mm in fellow eyes of BRVO and 23.38±0.92 mm in eyes of group B. The differences were statistically significant (p<0.05) between two groups.

Table-8: Comparison between axial length of eyeball in affected and fellow eyes in BRVO patients of group A with eyes of group B

	n	Axial length of eyeball (mm)				P value
		Mean	±SD	Min	-max	
Affected eyes	18	22.69	±0.54	21.24	-23.91	0.006[s]
Group B eyes	30	23.38	±0.92	21.92	-25.05	
Fellow eyes	16	22.70	±0.71	21.07	-23.97	0.014[s]
Group B eyes	30	23.38	±0.92	21.92	-25.05	

s= significant

P value reached from unpaired t-test

DISCUSSION

In this present study the mean age was found 45.3±8.0 years in group A and 42.1±5.0 years in group B. The difference was not statistically significant (p>0.05) between two groups. Szigeti *et al.*, (2015) observed that the mean age was found 66±14 years in Central Retinal Vein Occlusion (CRVO) group, 63±12 years in Branch Retinal Vein Occlusion (BRVO) group and 64±14 years in control group. The difference was not statistically significant (p>0.05) between two groups. Aritirk *et al.*, reported that the mean age was found 63.87 years in CRVO group, 59.33 years in BRVO group and 62.77 years in control group [1]. The difference was not statistically significant (p>0.05) between two groups. Mousavi *et al*., observed that the mean age of CRVO and BRVO patients was 57.5±13.4 and 52.9±9.3 years, respectively (P=0.37) [9].

Mean age of patient in control group was 59±16 years and did not differ significantly with other groups (P>0.05). Now day's systemic risk factors like hypertension, dietetics mellitus are appearing in younger age due to sedentary lifestyle, stress, obesity. That's why we have found patients with Retinal Vein Occlusion (RVO) at a younger age.

In this series it was observed that in group A, 10(33.3%) patients were myopic, 10(33.3%) were hypermetropic, 4(13.3%) were emmtropic and 6(20.0%) were having emmtropia with presbyopia. In some studies it was revealed that severe myopia is associated with vascular damage particularly in diabetic patients, because it can reduce blood flow of retina [10].

A high incidence of hyperopia has been reported to be associated with CRVO [11]. Previous studies only compared the 2 eyes of the same patient or investigated the amount of hyperopia as possible risk factors, so some controversial issues do exist [12].

In this present study it was observed that mean axial length of eyeball was found 22.81±0.67 mm in affected eyes of group A and 23.38±0.92 mm in eyes of group B. The mean axial length of eyeball was found 22.82±0.78 mm in affected eyes of group A and 23.38±0.92 mm in eyes of group B. The differences were statistically significant (p<0.05) between two

groups. Szigeti *et al*., observed significantly shorter axial length in the affected eyes of patients with CRVO and BRVO compared with control eyes [10].

In this current study it was observed that mean axial length of eyeball was found 22.98±0.82 mm in affected eyes of CRVO in group A and 23.38±0.92 mm in eyes of group B. The mean axial length of eyeball was found 22.96±0.88 mm in fellow eyes of CRVO in group A and 23.38±0.92 mm in eyes of group B. The differences were not statistically significant (p>0.05) between two groups. Szigeti *et al*., observed that mean axial length (22.89±0.89 mm) of affected eyes in the CRVO group was significantly shorter than those of the control eyes (23.45±0.69 mm) (p=0.001), mean difference was 0.56±0.15 mm in axial length. The mean axial length of affected eyes in CRVO patients was significantly shorter than those of the unaffected fellow eyes (p <0.001). Some studies did not find differences in axial length in eyes with CRVO compared with unaffected fellow or control eyes, similar to the present study [13, 14].

Cekic *et al*., suggested that eyes with shorter axial length may be predisposed to greater crowding of the central retinal vein and artery at the lamina cribrosa and are therefore more likely to develop CRVO [2].

Mehdizadeh *et al*., reported that the mean axial length of the affected eyes was 22.71±0.85 mm and the mean axial length of the healthy eyes was 23.23±0.71 mm [15].

The difference was statistically significant (p = 0.007). The axial length of the healthy fellow eyes in the CRVO group was less than the axial length of the control group (p = 0.04). Aritirk *et al*., observed that in CRVO, the mean ocular axial length of the affected eyes was 22.25±0.19 mm and control eyes was 23.22±0.09 mm [1].

The mean ocular axial length of the unaffected eyes was 22.61±0.13 mm and control eyes were 23.22±0.09 mm. The difference were statistically significant (p<0.05) between two groups. Kumar *et al*., and Brown *et al*., have shown that, in eyes with CRVO, axial length is shorter than in control eyes, but no significant difference was found between affected eyes and contralateral unaffected eyes [16, 17].

In this study it was observed that mean axial length of eyeball was found 22.69±0.54 mm in affected eyes of BRVO in group A and 23.38±0.92 mm in eyes of group B. The mean axial length of eyeball was found 22.70±0.71 mm in fellow eyes of BRVO in group A and 23.38±0.92 mm in eyes of group B. The differences were statistically significant (p<0.05) between two groups. Szigeti *et al*., found that there was no statistically significant difference between the affected and unaffected fellow BRVO eyes. Mean axial length of the affected and unaffected fellow eyes in the BRVO group was significantly shorter than those of the control eyes (p <0.001). Axial length of the affected eyes was shorter with a mean difference of 0.57±0.15 mm comparing with the control eyes. Mean axial length of the unaffected fellow eyes was shorter than the control eyes with 0.53±0.16 mm. Some studies did not find differences in axial length in eyes with BRVO compared with unaffected fellow or control eyes [2].

In contrast to these studies, other found significantly shorter axial length in the affected eyes of patients with BRVO compared with control eyes, similar to the present study [15].

Mousavi *et al*., found that the mean axial length did not differ in fellow eye in BRVO and control group (p=0.54). Aritirk *et al*., [9] observed that in BRVO, The mean ocular axial length of the affected eyes was 22.89±0.11 mm and control eyes were 23.22±0.09 mm [1]. The mean ocular axial length of the other unaffected eyes was 22.99±0.09 mm and control eyes were 23.22±0.09 mm. The difference between the mean ocular axial lengths of the involved eyes and contralateral unaffected eyes was not statistically significant (p>0.05) but the difference between the control eyes and affected eyes was statistically significant (p<0.05). Mousavi *et al*., reported the mean axial length did not differ in fellow eye in BRVO and control group (p=0.54) [9]. We have found smaller axial length in patients with retinal vein occlusion, axial length is anatomically and genetically determined so it may vary from one individual to another.

CONCLUSION

- On the basis of the findings in this study, it may be surmised that shorter axial length may be a local risk factor for developing RVO.

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