

Axial length, a risk factor for retinal vein occlusion: A case control study

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Abstract

Objective: To evaluate the role of axial length in cases of retinal vein occlusion.

Methods: The case-control study was conducted at Layton Rahmatullah Benevolent Trust Eye Hospital, Karachi, from March to August 2018, and comprised patients with retinal vein occlusion and age-matched controls. Axial length of both eyes of all the subjects was calculated. The length of the affected eye was compared with that of the contralateral unaffected eye and also with the controls. Data was analysed using SPSS 21.

Results: There were 70 subjects; 35(50%) in each of the two groups. Among the cases, 16(46%) were males and 19(54%) were females. The overall mean age of the group was 37 ± 4.2 years. Among the controls, 21(60%) were males and 14(40%) were females. The mean age of the group was 36.5 ± 4.5 years. Also, among the cases, 23(66%) had unilateral central retinal vein occlusion and 12(34%) had branch retinal vein occlusion. Mean axial length was 0.80mm shorter in central retinal vein occlusion patients and controls ($p=0.01$). Branch retinal vein occlusion group did not show statistical significance on comparing with fellow eyes ($p=0.18$) and with controls ($p=0.07$).

Conclusion: Axial length was found to be a local predisposing factor to develop retinal vein occlusion.

Keywords: Retinal vein occlusion, RVO, Axial length, AL, A-scan ultrasonography, A-scan. (JPMA 69: 1800; 2019)

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Introduction

After diabetic retinopathy, retinal vein occlusion (RVO) is the most common cause of visual loss globally.¹ The exact pathophysiology of RVO is not clear, but age is one of the determining factors. Local factors such as compression, physical blockade of the vessels and other systemic hemodynamic factors, such as hypertension (HTN), hyperlipidaemia, arteriosclerosis, diabetes mellitus (DM), glaucoma, axial length, cigarette smoking and oral contraceptive pills (OCPs) can contribute to RVOs.^{2,3}

RVO is classified according to the site of the venous occlusion e.g. central retinal vein occlusion (CRVO), and branch retinal vein occlusion (BRVO).⁴ And the most common site involved in BRVO is superior temporal branch (65%), due to increased atrioventricular (AV) crossing at this site.⁵ RVOs can be further divided into perfused (non-ischemic) and non-perfused (ischemic) types.⁶

Thrombus formation following the Virchow's triad for thrombogenesis involves vessel damage, stasis and hypercoagulability. Damage to the retinal vessel wall from arteriosclerotic thickening is associated with compression of veins at arteriovenous crossings, leading to secondary changes that include endothelial cell loss, turbulent flow and ultimately occlusion. In CRVOs, this

thrombus formation occurs at or near the lamina cribrosa region, whereas in BRVOs the site of occlusion is invariably the arteriovenous junctions.⁷⁻¹⁰

One of the prominent predisposing factors to pathogenesis of RVOs is shorter axial length (AL) of the eye (<23 mm). Smaller AL leads to a shorter lamina cribrosa and comparatively narrow scleral canal, causing a narrow passage for retinal artery and vein. This narrow passage predisposes to the physical compression of the vein and eventually results in thrombus formation.^{11,12} However, the role of AL is still controversial and the results of ocular biometric readings in RVO are inadequate.

The RVO in patients without systemic diseases is comparatively less prevalent. Not much data is available on the role of short axial length and incidence of RVO. The current study was conducted to assess the incidence of shorter axial length (AL) in patients presenting with RVO without any co-morbid in our setup.

Patients and Methods

The case-control study was conducted at the Layton Rahmatulla Benevolent Trust (LRBT) Free Base Eye Hospital, Karachi, from March to August 2018. After approval was obtained from the institutional ethics review committee, the sample size was calculated using OpenEpi calculator version 3.01, setting 0.4% prevalence of RVO at 5% margin of error and 95% confidence interval (CI).^{13,14} Informed consent was obtained from all the patients included in the study. All patients with positive clinical findings of RVO visiting Medical Retina Clinic

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during the study period were evaluated for systemic history. Only patients having no co-morbid conditions were selected for AL measurement.

All patients underwent systemic examination, including fasting blood glucose (FBG), complete blood count (CBC) with peripheral film, systemic blood pressure (BP) measurement and detailed cardiovascular examination. Ophthalmic examination included visual acuity (VA) measurement with Snellen's chart, slit lamp biomicroscopy, intraocular pressure (IOP) measurement with applanation tonometry, and AL measurement by A-scan ultrasonography (SONOMET-USA). During A-scan, instructions were given to each patient to focus on the red light in the centre, and constant measurements were taken as prime AL. All the patients were examined by the same person to minimise errors.

Data acquisition was done by an investigator independently. Statistical analysis was done using SPSS 21. In patients with RVO, the affected eye AL was compared with the unaffected eye AL and with the control group. Paired t tests were performed and $p < 0.05$ was considered significant.

Results

During the study period, 125,175 visited the hospital out of whom 2780 (2.2%) patients visited the Medical Retina Clinic. Of them, 723 (26%) had positive clinical findings of RVO. From among them, 46 (6.4%) patients had history of no systemic disorders. On actual testing, 11 (24%) patients were excluded due to systemic diseases, including diabetes mellitus, hypertension, and hyperlipidaemia. The final sample, as such, stood at 35 (76%) cases. Among them, 16 (46%) were males and 19 (54%) were females. The

overall mean age of the group was 37 ± 4.2 years. Among the matching controls, 21 (60%) were males and 14 (40%) were females. The mean age of the controls was 36.5 ± 4.5 years. Among the cases, 23 (66%) had unilateral CRVO and 12 (34%) had BRVO. Of the CRVO patients, 14 (61%) were males and 9 (39%) were females, with an overall mean age of 35 ± 4.3 years. The right eye was affected in 14 (58.3%) patients and the left eye in 9 (37.5%). Further, 16 (69.5%) had history of spectacles ranging from +0.5D to +2.0D. Mean AL of the affected eye was 22.59 ± 0.35 whereas mean AL of the unaffected eye was 23.28 ± 0.43 . The AL of the affected eyes was significantly shorter in CRVO patients ($p < 0.05$).

Among the 12 BRVO patients, 4 (33.3%) were males, and 8 (66.6%) were females, with an overall mean age of 38 ± 5.3 years. The right eye was affected in 7 (58.3%) cases and the left eye in 5 (41.6%). Superior temporal branch was involved in 8 (66.6%) eyes, inferior temporal in 3 (25%) and inferior nasal branch in 1 (0.83%) eye. The hindrance to the blood flow was near the optic disc. The mean AL in BRVO eyes was 22.51 ± 0.5 , while in the unaffected eyes it was 23.14 ± 0.38 . The mean difference between the AL of affected and the fellow eyes was 0.63mm ($p = 0.18$) (Table-1).

AL of CRVO group with controls were shorter than the BRVO group (Table 2).

Discussion

The overall incidence of RVO in our study was 0.51%. In a study using pooled population-based data in the United States on 68,751 individuals from 15 studies, showing overall RVO incidence of 4.4%.¹⁵ This number is significantly higher compared to a study in which the incidence was 1.8% BRVO and 0.5% CRVO.¹⁶ This difference in the incidence could be because of the fact that our study was of 4-month duration while the earlier study spanned 15 years.¹⁶

In the current study, CRVO incidence was slightly higher compared to BRVO. Studies on retinal vein occlusion have highlighted that BRVO is more common than CRVO.¹⁷⁻¹⁹ This difference can be because of the fact that the current study population only included individuals without comorbidities and were younger (mean age 39 years) compared to the studies mentioned above where the mean age was significantly higher (mean age 55 years).

Most of the previous studies reported that RVO is related to old age and associated with systemic diseases, like hypertension, diabetes, arteriosclerosis, and hyperlipidaemia.^{17,18} In contrast, the current study assessed RVO risk in a young population, and CRVO was found to be

Table-1: Comparison of AL of affected eyes with fellow eyes.

Type of RVO	Mean AL of Affected Eye (mm)	Mean AL of Unaffected Eye (mm)	P value
CRVO	22.30 ± 0.43	23.16 ± 0.49	0.01
BRVO	22.51 ± 0.55	23.14 ± 0.38	0.18

RVO: Retinal vein occlusion; CRVO: Central retinal vein occlusion; BRVO: Branch retinal vein occlusion; AL: Axial length.

Table-2: Comparison of AL of affected eyes with age match control adults.

Type of RVO	Mean AL of Affected Eye (mm)	Mean AL of Control Group (mm)	P value
CRVO	22.30 ± 0.43	23.33 ± 0.53	0.01
BRVO	22.51 ± 0.55	23.03 ± 0.38	0.07

RVO: Retinal vein occlusion; CRVO: Central retinal vein occlusion; BRVO: Branch retinal vein occlusion; AL: Axial length.

more prevalent in males. The only associated factor the current study explored was ocular AL. The study demonstrated that in young otherwise fit and healthy patients, shorter ocular AL can be a predisposing factor for CRVO ($p < 0.05$) while there was no statistical significance in the BRVO population. A study in China reported that the ALs of affected eyes were usually shorter than the unaffected eyes, especially in BRVO patients.²⁰ Another study reported that in both CRVO and BRVO, the affected eye had shorter AL compared to the unaffected eye.²¹ Some studies did not find differences in AL in CRVO or BRVO eyes compared to unaffected contralateral eye, or to the eyes of controls.²²⁻²⁶

The small sample size of the current study is a limitation. Large-scale, multicentre studies are needed to endorse the findings of the current study.

Conclusion

Short AL was found to be a major contributing factor for RVOs in young and healthy individuals.

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Conflict of Interest: None.

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