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Axial length, refractive error, and keratometry in patients with branch retinal vein occlusion

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PURPOSE. *To evaluate ocular parameters that may predispose to the development of branch retinal vein occlusion (BRVO).*

METHODS. *This prospective study included patients with unilateral BRVO evaluated in the authors' clinic. The mean period from the acute phase was 2.29 ±1.57 years (range 1-6 years). All patients underwent a complete ophthalmologic examination including subjective refraction, axial length measurements, and keratometry readings. The fellow eye served as a control in each patient. The variables of interest were compared between the affected eye and the fellow eye using the parametric t-test and the nonparametric Wilcoxon test.*

RESULTS. *Twenty-four consecutive patients (14 women, 10 men, mean age 62.4 years) were included in the study. The mean axial length in the affected eye was significantly shorter compared to the mean fellow eye length. No difference was found between the two eyes in mean subjective refraction or mean keratometry readings.*

CONCLUSIONS. *The authors found that eyes with BRVO have a shorter axial length compared to the fellow eye in the same patient. (Eur J Ophthalmol 2004; 14: 37-9)*

KEY WORDS. *Axial length, Branch retinal vein occlusion, Keratometry, Refraction*

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INTRODUCTION

Branch retinal vein occlusive disease (BRVO) is the second most common vascular disorder after diabetic retinopathy (1, 2). Systemic as well as ocular factors have been found to contribute to the development of retinal vein occlusions. Systemic risk factors include hypertension, cardiovascular disease, increased body mass index, and increased serum levels of alfa 2 globulin and triglycerides (3-8). The main ocular risk factors are refractive hyperopia, elevated intraocular pressure (IOP), and shorter axial length (4, 5, 7-12). To our knowledge, none of the previous studies examined the following three factors contributing to the final refractive status of the patient: axial length, subjective refraction, and keratometry. We conducted a retrospective study in order to find a possible correlation between these three factors and the development of BRVO.

MATERIALS AND METHODS

Twenty-four consecutive patients with BRVO who attended the retina unit in the Tel Aviv Medical Center were included in the study. Informed consent was obtained from all participants in the study. No patient had a history of any other retinal disease, eye trauma, intraocular inflammation, or ophthalmic surgery prior to diagnosis of retinal vein occlusion. All patients included in the study had unilateral BRVO and had a normal fellow eye with no previous ocular disease. No fellow eyes developed branch vein occlusion during the follow-up period. In 18 patients, the superior-temporal branch was involved; in 4 patients, the inferior-temporal branch; and in 2 patients, a nasal vein. In all patients the occlusion was within 3 disc diameters from the optic disc. Ten patients were treated with laser for macular edema previously, but when included in the study none of them had noticeable retinal thick-

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ness in the macula. The mean interval between the acute phase of the occlusion and our examination was 2.29 ±1.57 years (range 1-6 years).

A complete ophthalmic examination was performed in both eyes in all patients, including slit-lamp biomicroscopy, gonioscopy, IOP measured by applanation tonometry, and fundus examination using a three mirror Goldmann contact lens. Each patient underwent a subjective refraction, axial length measurements, and keratometric readings. The subjective refraction was summarized in spherical equivalent in diopters ± standard deviation. Axial length was measured in millimeters (mm) using the ultrasonic biometer (model 870, Humphrey Allergan) and calculated as an average of five repeated measurements. Keratometry readings in diopters were obtained using the Topographic Modeling System (TMS-1). The average of K1 and K2 was recorded. The affected eye was compared with the fellow eye of the same patient, with respect to refraction, axial length, and keratometric measurements.

Statistical analysis

The variables of interest were compared between the affected eye and the fellow eye using the parametric paired t-test and the nonparametric Wilcoxon test.

RESULTS

Twenty-four patients (14 women, 10 men), mean age 62.4 years (range, 54 to 76 years), with BRVO were included in the study.

The mean axial length was 22.82±0.94 mm in affected eyes and 23.05±0.87 mm in fellow eyes. The mean axial length in affected eyes was significantly shorter compared to fellow eyes (p=0.037). Subjective refraction was 0.96±2.27 diopters in affected eyes and 1.08±2.40 diopters in fellow eyes. There was no significant difference in mean subjective refraction between the two groups (p=0.55). Mean keratometric readings were 44.26±1.50 diopters in affected eyes and 44.14±1.82 diopters in fellow eyes. There was no significant difference in mean keratometric readings between the two groups (p=0.40).

Mean IOP was 15.09±2.90 mmHg in affected eyes and 15.50±3.44 mmHg in fellow eyes; this difference was not significant (p=0.14).

Table I summarizes the ocular parameters in affected eyes versus fellow eyes.

Similar results were found using the nonparametric Wilcoxon test with a p value of 0.027 for axial length measurements, p value of 0.14 for spherical equivalent, p value of 0.46 for mean keratometry readings, and p value of 0.25 for IOP.

DISCUSSION

In this study we demonstrated that eyes with BRVO had a significantly shorter axial length than the fellow eye of the same patient, whereas there was no significant difference in keratometry, spherical equivalent, or IOP between the affected eye and fellow eye of the same patient.

Multiple studies in the ophthalmologic literature have dealt with the possible correlation between BRVO and various hyperopic parameters such as axial length, spherical equivalent, and keratometry readings, with contradictory results. Aritürk et al (9) measured axial length in patients with BRVO and found a statistically significantly shorter axial length in the eyes with BRVO compared to the fellow eyes and to a control group. Timmerman et al (10) found a shorter axial length in 24 patients with BRVO compared to a matched control group of eyes, but not to the fellow eyes of the same patients. Çekiç et al (12) found no difference in axial length among eyes with BRVO, fellow eyes, and control eyes. Simons and Brucker (6) found no significant difference in axial length between eyes with BRVO and a matched control group. Unlike their study, we compared the affected and fellow eye of the same patient. Majji et al (11) studied hyperopia as a risk factor for the development of BRVO. They found an increased risk of hyperopia in eyes with BRVO. Saxena et al (13) found patients with BRVO to be significantly more hyperopic than a control group. As summarized by Çekiç et al (12), different demographic characteristics of patients with BRVO and the use of different statistical methods may have contributed to this discrepancy. In addition, to our knowledge, none of the previous studies analyzed axial length, spherical equivalent, and keratometry readings in the same group of patients. We estimated that in order to establish actual risk factors for BRVO, all three parameters should be evaluated in the same patient, comparing the affected with the fellow eye.

Our results strengthen the common belief that the main ocular risk factor for the development of BRVO is a short-

TABLE I - COMPARISON OF OCULAR PARAMETERS BETWEEN AFFECTED EYES WITH BRANCH RETINAL VEIN OCCLUSION AND NORMAL FELLOW EYES

Parameter	Affected eye	Fellow eye	p value
Mean axial length (mm)	22.82±0.94	23.05±0.87	0.037
Mean keratometric readings (diopters)	44.26±1.50	44.14±1.82	0.40
Mean spherical equivalent (diopters)	0.96±2.27	1.08±2.40	0.55
Intraocular pressure (mm Hg)	15.09±2.90	15.50±3.44	0.14

er axial length. The pathogenic mechanisms of a correlation between shorter axial length and BRVO are not completely clear. Çekiç et al (12) have suggested that a shorter axial length might be associated with an impairment in blood flow in the central retinal vein, with further possible reduction in the more distal retinal veins in general, and in arteriovenous crossing sites in particular, thus contributing to the formation of BRVO. Such reduced flow might be caused by a smaller caliber retinal vasculature in hyperopic eyes as demonstrated by Suzuki et al (14), explaining possible beneficial effects of retinal vein sheathotomy for the treatment of BRVO as described by Opremcak and Bruce (15).

Further studies are needed to confirm the importance of ocular parameters on the pathogenesis of venous vascular occlusion.

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