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Original Research Article

Intraocular Pressure Patterns in the Eye with Retinal Venous Occlusions: A Comparative Study

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Abstract:

Background and Objectives: Retinal venous occlusion (RVO) is the second most common retinal vascular disease after diabetic retinopathy and is a major cause of visual loss worldwide. Age is the most important risk factor. Major local risk factor is glaucoma.

Though glaucoma has been described as a risk factor for RVO, not many studies describe the occurrence of drop in intraocular pressure (IOP) following venous occlusive event and its mechanism. This study was an attempt to assess intraocular pressure (IOP) pattern of affected eye of patients with RVO compared with normal fellow eye.

Material and Methods: The study had a comparative design and was done inside the setting of a hospital. Patients with unilateral retinal vein occlusion (RVO) were chosen from the Ophthalmology Outpatient Department (OPD) at the Ophthalmology department of the Government Medical College and Hospital in Kozhikode, Kerala, India using a convenient sampling method. This was accomplished subsequent to receiving authorization from the Scientific Review Committee and Institutional Ethics Committee, as well as obtaining written agreement from the patients. The ocular examination encompassed a thorough assessment of the anterior segment using a slit lamp, evaluation of visual function, measurement of intraocular pressure (IOP), and inspection of the fundus. SPSS was utilized for statistical analysis.

Results: Mean age of retinal vein occlusion is 57.3 years. RVO is seen more commonly in males (60%).Slight preponderance of left eye affection (56.67%) is seen. In patients with central retinal vein occlusion, intraocular pressures of affected eyes, on comparing with normal fellow eyes, show no significant difference in each visit. In patients with branch retinal vein occlusion, intraocular pressures at subsequent visits show statistically significant difference between affected and unaffected eyes, with IOP being lower in affected eyes.

Conclusion: RVO is a common vascular disease of retina, of which, Superotemporal branch retinal vein occlusion is the most common type. Present study did not find any statistical significant difference between intraocular pressures of central retinal vein occlusion (CRVO) in affected eye and normal fellow eye. In branch retinal vein occlusion (BRVO), there was significant difference between intraocular pressures of affected eye and normal fellow eye on follow-up.

Keywords: Applanation tonometry; Branch retinal vein occlusion; Central retinal vein occlusion; Intraocular Pressure; Schiotz tonometry.

Introduction

Retinal vein occlusion (RVO) is the second most prevalent retinal vascular disease.

Based on the zone of retinal vein drainage, it is categorized as branch retinal vein occlusion (BRVO), central retinal vein occlusion (CRVO), and hemi-retinal vein occlusion (HRVO). [1,2] The correlation between retinal vein occlusion (RVO) and elevated intraocular pressure (IOP)/glaucoma has been extensively documented. [3-6] Glaucoma is a prominent contributor to permanent vision loss on a global scale, and the number of people affected by glaucoma is projected to rise from 76 million in 2020 to 111.8 million in 2040. [7-9] identifying the role of intraocular pressure in the pathophysiology of RVO may facilitate the development of novel approaches for the management and modification of RVO patient outcomes. This study is an attempt to assess IOP pattern of affected eye of patients with RVO compared with normal fellow eye.

Aim and Objectives: To assess the changes in intraocular pressure pattern secondary to retinal

venous occlusion in comparison to the normal fellow eye.

Material and Methods:

The study had a comparative design and was done inside the setting of a hospital. Patients with unilateral retinal vein occlusion (RVO) were chosen from the Ophthalmology Outpatient Department (OPD) at the Ophthalmology department of the Government Medical College and Hospital in Kozhikode, Kerala, India using a convenient sampling method. This was accomplished subsequent to receiving authorization from the Scientific Review Committee and Institutional Ethics Committee (GMCKKD/RP2016/EC/230), as well as obtaining written agreement from the patients.

Inclusion Criteria: Unilateral retinal vein occlusions including central retinal vein occlusion, hemicentral retinal vein occlusion and major branch retinal vein occlusions in 25-75 years age group in both sexes and with or without co morbidities.

Exclusion Criteria:

- Bilateral retinal vein occlusions
- RVO complicated by neovascular glaucoma
- Patients with intraocular inflammations
- Recent ocular trauma
- Recent ocular surgery within 1yr
- Glaucoma on treatment
- Patients taking IOP affecting drugs.

Sample size: 30

According to equation $(Z\alpha+Z\beta)^2SD^2/d^2$.

Za=1.96, Zb=0.84, SD=2.85, d=1.5 based on observation in a study conducted by J Frucht published in Br J Ophthal.

(n=sample size, SD=standard deviation, D=Precision)

Methodology:

Detailed history was taken, general and systemic examinations were done. Ocular examination included slit lamp examination of anterior segment, functional visual assessment, IOP recordings and fundus examination.

IOP recorded in 1st visit after occlusive event in both eyes by Applanation tonometry and schiotz tonometry. Recordings repeated 1 and 3 months following 1st visit.

In follow up visits also IOP recorded by applanation tonometry and schiotz tonometry in both the eyes.

Statistical Analysis: The data was encoded and analyzed using the programme Statistical Package for Social Science version 18.0. The association between several qualitative variables was evaluated using a chi-square test. The statistical review found that the probability value, p, was significant at a level of less than 0.05.

Results

A total of 30 patients were selected by convenient sampling. In present study, age ranged from 34-73 years. The demographic profile of study population was as shown in Table 1.

Table 1: Demographic variables

Variables		N	%
Age groups	<40 years	02	6.67
	40-60 years	16	53.33
	>60 years	12	40
Gender	Male	18	60
	Female	12	40
Laterality	Right eye	13	43.33
	Left eye	17	56.67
Type of occlusion	Ischemic CRVO	01	3.33
	Non ischemic CRVO	10	33.33
	Hemi CRVO	03	10
	ST BRVO	12	40
	IT BRVO	02	6.67
	Macular BRVO	02	6.67
Visual Acuity (Snellen's)	≤ 6/60	16	53.33
	6/60 – 6/18	10	46.67
	≥ 6/18	04	13.33

In present study, mean IOP values of all RVO affected eyes by Applanation Tonometry (AT) at baseline was same as that of unaffected eye. Mean AT values at repeated visits was slightly less than that of unaffected eyes, which was not statistically significant in this study. In CRVO affected eyes, mean AT value on comparing with normal fellow eyes, also showed statistically insignificant difference in each visit. In BRVO group, mean AT values at 1 month and 3rd month visits showed statistically significant difference between affected and unaffected eyes with IOP being lower in affected group (p=0.01). [Table 2]

Table 2: Mean IOP values by Applanation Tonometry (AT)

Variables		Affected eye Mean (SD)	Unaffected eye Mean (SD)	P- value
In all RVO	AT – Baseline	15.7 (2.5)	15.7 (2.3)	1.00 (NS)
	AT – 1 month	15.0 (2.4)	15.5 (2.0)	0.13 (NS)
	AT – 3 months	14.6 (2.0)	15.3 (2.3)	0.06 (NS)
In CRVO	AT – Baseline	16.4 (2.9)	15.6 (2.0)	0.37 (NS)
	AT – 1 month	16.0 (3.1)	15.5 (2.5)	0.34 (NS)
	AT – 3 months	15.1 (2.3)	15.3 (1.6)	0.72 (NS)
In BRVO	AT – Baseline	15.2 (2.2)	16.0 (2.5)	0.13 (NS)
	AT – 1 month	14.4 (2.1)	15.5 (1.9)	0.01 **(S)**
	AT – 3 months	14.1 (2.1)	15.4 (2.9)	0.01 **(S)**

NS- Not Significant, S- Significant. In present study, mean IOP values of all RVO affected eyes by sciotz tonometry at baseline and at repeated visits were similar to that of unaffected eyes. In CRVO group, mean schiotz value of affected eyes on comparing with normal fellow eyes, also showed statistically insignificant difference in each visit. In BRVO group, mean schiotz values at baseline and 1 month visits show statistically significant difference between affected and unaffected eyes with IOP being lower in affected group (p= 0.03 & 0.01, respectively). [Table 3]

Table 3: Mean IOP values by Sciotz Tonometry

Variables		Affected eye Mean (SD)	Unaffected eye Mean (SD)	P- value
In all RVO	schiotz – Baseline	15.1 (2.8)	15.9 (2.7)	0.12 (NS)
	schiotz – 1 month	15.1 (2.6)	15.9 (2.4)	0.09 (NS)
	schiotz – 3 months	15.1 (2.0)	15.5 (2.5)	0.36 (NS)
In CRVO	schiotz – Baseline	16.4 (2.9)	15.6 (2.0)	0.37 (NS)
	schiotz – 1 month	17.1 (1.0)	16.9 (0.5)	0.79 (NS)
	schiotz – 3 months	16.4 (0.9)	16.0 (0.7)	0.61 (NS)
In BRVO	schiotz – Baseline	14.0 (1.9)	15.8 (3.1)	0.03 **(S)**
	schiotz – 1 month	14.3 (2.3)	16.1 (2.5)	0.01 **(S)**
	schiotz – 3 months	14.7 (1.7)	15.6 (2.8)	0.16 (NS)

NS- Not Significant, S- Significant. Mean AT value of affected eyes at 3 months visit when compared with baseline AT value shows statistically significant difference with a p value <0.05. [Table 4]

Table 4: Comparison of IOP values during follow-up by Applanation Tonometry

Variable	AT-baseline Mean (SD)	AT-3months Mean (SD)	Difference Mean (SD)	P- value
Affected eye	15.7 (2.5)	14.6 (2.0)	1.1 (1.8)	0.003 **(S)**
Unaffected eye	15.7 (2.3)	15.3 (2.3)	0.4 (1.8)	0.23 (NS)

NS- Not Significant, S- Significant. There is no statistically significant difference between mean IOP value with schiotz tonometry of affected eye at 3 months and at baseline. [Table 5]

Table 5: Comparison of IOP values during follow-up by Sciotz Tonometry

Variable	AT-baseline Mean (SD)	AT-3months Mean (SD)	Difference Mean (SD)	P- value
Affected eye	15.1 (2.8)	15.1 (2.0)	0.0 (2.0)	0.99 (NS)
Unaffected eye	15.9 (2.7)	15.5 (2.5)	0.5 (1.7)	0.13 (NS)

NS- Not Significant

Discussion

In our study, 30 subjects with age ranging from 34 to 73 years were included by convenient sampling. We found that mean age of subjects was 57.3 years, with mean age of CRVO being 58.36 years, and that of hemi CRVO and BRVO being 60 and 56.06 years respectively. 53.33% RVO cases belonged to age group of 40-60 years in our study. But in most of studies related to RVO, it has been found to occur in 6th and 7th decades of life. [10-12] Males and females were affected in a ratio of 1.5:1 in this study. Although there is no gender predilection in many of the studies, in a study by Hayreh SS, all categories of RVO, except major BRVO, were more common in men than in women. [3] Explanation for increased incidence of RVO in males is on hormonal basis. Higher haematocrit in males could act as a contributory factor in elevating blood viscosity and producing RVO. [12]

In the present study, there is a slight preponderance in occurrence of occlusion in left eye (56.67%) compared to right eye (43.33 %).In the study by

Hayreh, it was found that only ischemic CRVO and major BRVO showed evidence that RVO occurs more often in one (major BRVO in right eye in 57%) or the other (ischemic CRVO in left eye in 57%) eye. Among the other 4 types of RVO there was no significant difference between the involvements of the two eyes. [3]

In our study, among the different types of occlusions, ST BRVO was the most common type (seen in 40% cases) followed by non-ischemic CRVO (33.33%).Total BRVO cases constitute 53.3%,CRVO 36.67% and hemi CRVO 10%. According to Michell P et al BRVO constitute 69.5%, HCRVO-5.1%, CRVO-25%3 .Branch retinal vein occlusion study group conclude that BRVO is 2 to 6 times more common than CRVO. [13]

In present study, IOP values range from 10.2 to 22 mmHg. Mean IOP value of CRVO affected eyes by AT is 15.8±0.7 mmHg and by schiotz tonometry is 16.4±0.7 mmHg and that of unaffected eye of CRVO patients by AT and schiotz are 15.5±0.2mmHg and 15.8±0.2mmHg respectively. Mean IOP value of BRVO affected eyes by AT is 14.6±0.6 mmHg and by schiotz tonometry is 14.3±0.4 mmHg and that of unaffected eye of BRVO patients by AT is 15.6±0.3 mmHg and by schiotz tonometry is 15.8±0.3 mmHg.

Large population based studies have revealed a mean IOP of 15.5mmHg±2.6mmHg.In a study by J Frucht et al [14] ,in the group of patients with the CRVO, the intraocular pressures were between 12-23mmHg with a mean value of 16.87±2.82mmHg. The intraocular pressures in the unaffected eyes were similar to those in the affected eyes. The intraocular pressures in the BRVO group ranged from 9 to 22 mmHg, exhibiting a mean value of 15.2±3.08 mmHg. In his study, there was no disparity in intraocular pressures between the affected and unaffected eyes within the BRVO group.

Hayreh et al observed a decrease in intraocular pressure (IOP) after the occurrence of venous occlusion. [15] In his study of 130 cases of unilateral RVO, he found that more than 80% of the patients had a lower IOP in the eye with the occlusion than in the fellow normal eye. The reduction of IOP was greater with central than with branch vein occlusion. They assumed that the drop of IOP is a result of the vein thrombosis.

Mean IOP by applanation tonometry of affected eyes at 3rd month visit when compared with baseline value shows statistically significant difference in this study. However there are no known studies on retinal vein occlusion comparing the IOP values between affected and normal fellow eye on repeated visits after the venous occlusive event.

Limitations of the study

Since current sample size was small, studies with more number of patients are required to statistically analyze the IOP patterns in RVO and to accurately establish its clinical significance. The study population may not represent the general population as it is conducted in a tertiary center. Our study did not take ocular rigidity and central corneal thickness into consideration, which may affect the IOP reading.

Conclusion

RVO is a common vascular disease of retina, of which, Superotemporal branch retinal vein occlusion is the most common type. The current investigation did not observe any statistically significant difference in intraocular pressures between the affected eye with central retinal vein occlusion (CRVO) and the unaffected fellow eye. Branch retinal vein occlusion (BRVO) resulted in a notable disparity in intraocular pressures between the affected eye and the unaffected eye over the follow-up period.

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