



Original Article

Intraocular Pressure Changes in the Affected and Fellow Eyes of Patients with Unilateral Retinal Vein Occlusion: A Prospective Observational Study

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ABSTRACT

Background: Retinal vein occlusion (RVO) is an important retinal vascular disorder associated with retinal hemorrhage, macular edema, retinal ischemia and, in severe cases, neovascular complications. Intraocular pressure (IOP) influences ocular perfusion and retinal vascular hemodynamics, and altered IOP may occur in eyes with RVO. Changes in the clinically unaffected fellow eye may provide additional insight into systemic or bilateral vascular dysregulation.

Aim: To evaluate and compare IOP in the affected and fellow eyes of patients with unilateral retinal vein occlusion and to assess changes in IOP over a three-month follow-up period.

Methods: This prospective observational study included 64 patients aged >18 years with unilateral RVO, including branch retinal vein occlusion (BRVO) and central retinal vein occlusion (CRVO), attending the Department of Ophthalmology, Minto Ophthalmic Hospital, Bangalore Medical College and Research Institute, Bengaluru. IOP was measured in both eyes using applanation tonometry at baseline, 1 month and 3 months. Patients with bilateral RVO, glaucoma, ocular trauma or surgery, or use of IOP-altering medications were excluded.

Results: The study included 64 patients; 42 (65.6%) were male and 22 (34.4%) were female. Mean age was 54.79 years. BRVO accounted for 53 (82.8%) cases and CRVO for 11 (17.2%). The right eye was involved in 44 (68.75%) patients and the left eye in 20 (31.25%). Mean IOP in the affected eye was significantly higher than in the fellow eye at baseline (15.10 ± 2.43 vs. 13.79 ± 2.42 mmHg; $p=0.004$), 1 month (15.76 ± 2.42 vs. 14.25 ± 2.50 mmHg; $p=0.001$), and 3 months (16.00 ± 2.69 vs. 15.00 ± 2.36 mmHg; $p=0.028$). Affected-eye IOP increased significantly from baseline to 1 month ($p=0.003$) and from baseline to 3 months ($p=0.020$), but not from 1 to 3 months ($p=0.415$). BRVO showed significant increases from baseline to 1 and 3 months, whereas CRVO showed no statistically significant longitudinal change. Fellow-eye IOP also increased significantly in the overall cohort from baseline to 1 month, 1 to 3 months, and baseline to 3 months.

Conclusion: Patients with unilateral RVO demonstrated higher IOP in the affected eye than in the fellow eye throughout three months of follow-up. IOP also increased in the fellow eye, particularly in BRVO, suggesting that pressure changes may not be confined to the clinically affected eye. Bilateral IOP monitoring during early follow-up may therefore be clinically relevant.

Keywords: retinal vein occlusion; branch retinal vein occlusion; central retinal vein occlusion; intraocular pressure; fellow eye; ocular perfusion; vascular dysregulation.

INTRODUCTION

Retinal vein occlusion (RVO) is a common retinal vascular disorder and an important cause of visual impairment in older adults. It is characterized by obstruction of the retinal venous system, resulting in retinal hemorrhage, macular edema and, in severe cases, retinal ischemia and neovascular complications. RVO is broadly classified into central retinal vein occlusion (CRVO) and branch retinal vein occlusion (BRVO).

Intraocular pressure (IOP) is an important determinant of ocular perfusion pressure and retinal and optic nerve head circulation. In RVO, altered IOP may interact with venous congestion, impaired aqueous outflow, ischemia and inflammatory mechanisms. Elevated IOP may further compromise ocular perfusion and may be particularly important in patients at risk of secondary or neovascular glaucoma.

The fellow eye is frequently used as an internal control in ophthalmic studies. However, patients with unilateral RVO may have systemic vascular or ocular abnormalities that influence both eyes. Evaluation of IOP in the fellow eye may therefore provide insight into whether pressure changes are restricted to the occluded eye or reflect broader physiological alterations. The present study evaluated IOP in the affected and fellow eyes of patients with unilateral RVO at presentation, 1 month and 3 months after diagnosis.

MATERIALS AND METHODS

Study design and setting

This prospective observational study was conducted at the Department of Ophthalmology, Minto Ophthalmic Hospital, Regional Institute of Ophthalmology, Bangalore Medical College and Research Institute, Bengaluru. The study period was May 2023 to October 2024. Institutional ethics approval was obtained and written informed consent was taken from all participants.

Participants

Patients aged >18 years with unilateral RVO were eligible. The study included BRVO and CRVO. Patients with bilateral RVO, glaucoma, ocular trauma, recent ocular surgery, or use of IOP-altering medications were excluded.

Ophthalmic assessment

All participants underwent detailed ophthalmic examination. IOP was measured in both eyes using applanation tonometry at the initial visit and repeated at 1-month and 3-month follow-up.

Sample size

The thesis reports a calculated sample size of 64 patients based on an expected effect size of 1.5 mmHg, standard deviation of approximately 3.02, 95% confidence level and 80% power.

Statistical analysis

Continuous variables were expressed as mean $\pm$ standard deviation and categorical variables as frequencies and percentages. Comparisons of IOP between eyes and across follow-up visits were performed as reported in the thesis. A p value <0.05 was considered statistically significant.

RESULTS

Demographic and clinical characteristics

Sixty-four patients were included. Forty-two (65.6%) were male and 22 (34.4%) were female. Mean age was 54.79 years. The largest age group was 51–60 years (26 patients, 40.6%), followed by 61–70 years (19, 29.7%) and 41–50 years (18, 28.1%). One patient (1.6%) was aged 30–40 years.

The right eye was involved in 44 (68.75%) patients and the left eye in 20 (31.25%). BRVO was present in 53 (82.8%) patients and CRVO in 11 (17.2%).

Table 1. Demographic and RVO characteristics

Characteristic	n	%
Male	42	65.6
Female	22	34.4
BRVO	53	82.8
CRVO	11	17.2
Right eye	44	68.75

Left eye	20	31.25
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Table 2. IOP in affected and fellow eyes at each follow-up

Time point	Affected eye, mean $\pm$ SD (mmHg)	Fellow eye, mean $\pm$ SD (mmHg)	p value
Baseline	15.10 $\pm$ 2.43	13.79 $\pm$ 2.42	0.004
1 month	15.76 $\pm$ 2.42	14.25 $\pm$ 2.50	0.001
3 months	16.00 $\pm$ 2.69	15.00 $\pm$ 2.36	0.028

Longitudinal IOP change in the affected eye

In the overall RVO cohort, affected-eye IOP increased from 15.10 $\pm$ 2.43 mmHg at baseline to 15.76 $\pm$ 2.42 mmHg at 1 month and 16.00 $\pm$ 2.69 mmHg at 3 months. The increase from baseline to 1 month was statistically significant ($p=0.003$), as was the increase from baseline to 3 months ($p=0.020$). The change between 1 and 3 months was not significant ($p=0.415$). In BRVO, mean affected-eye IOP increased from 14.66 $\pm$ 2.31 mmHg at baseline to 15.45 $\pm$ 2.42 mmHg at 1 month and 15.92 $\pm$ 2.71 mmHg at 3 months. Baseline-to-1-month and baseline-to-3-month comparisons were significant ($p=0.002$ for both), whereas the 1-to-3-month comparison was not significant ($p=0.092$). In CRVO, IOP was 17.27 $\pm$ 1.84 mmHg at baseline and 1 month and 16.36 $\pm$ 2.65 mmHg at 3 months; longitudinal comparisons were not statistically significant.

Longitudinal IOP change in the fellow eye

Fellow-eye IOP increased from 13.79 $\pm$ 2.42 mmHg at baseline to 14.25 $\pm$ 2.50 mmHg at 1 month and 15.00 $\pm$ 2.36 mmHg at 3 months. The changes were statistically significant for baseline to 1 month ($p=0.018$), 1 to 3 months ($p=0.0001$), and baseline to 3 months ($p<0.0001$).

In BRVO fellow eyes, IOP increased from 13.45 $\pm$ 2.30 mmHg at baseline to 14.07 $\pm$ 2.41 mmHg at 1 month and 14.75 $\pm$ 2.36 mmHg at 3 months, with significant changes across all reported intervals. In CRVO fellow eyes, IOP was 15.45 $\pm$ 2.38 mmHg at baseline, 15.09 $\pm$ 2.87 mmHg at 1 month and 16.18 $\pm$ 2.08 mmHg at 3 months; only the 1-to-3-month comparison was statistically significant ($p=0.047$).

DISCUSSION

The present study evaluated IOP trends in both eyes of patients with unilateral RVO over three months. The principal findings were that the affected eye had significantly higher IOP than the fellow eye at baseline, 1 month and 3 months, and that IOP increased over time in both eyes.

The mean age was 54.79 years, with most participants in the 51–70-year age range. There was a male predominance, with males comprising 65.6% of the cohort. BRVO was substantially more common than CRVO, accounting for 82.8% of cases. The affected eye demonstrated a significant increase in IOP during the first month and from baseline to three months, with no significant additional increase between months 1 and 3. This pattern suggests that the early post-diagnosis period may be particularly relevant to IOP changes. Potential mechanisms discussed in the thesis include venous congestion, increased episcleral venous pressure, impaired aqueous outflow, ischemia and inflammatory changes.

The BRVO subgroup demonstrated a consistent increase in affected-eye IOP, whereas the CRVO subgroup did not show statistically significant longitudinal changes. The relatively small CRVO sample ($n=11$) should be considered when interpreting this subgroup finding.

A notable observation was the progressive increase in fellow-eye IOP. Because the fellow eye is often treated as an internal control, this finding suggests that it may not always represent a completely unaffected physiological control in patients with unilateral RVO. The thesis discusses possible systemic or bilateral vascular dysregulation as an explanation, although the present study does not establish causality.

These findings support bilateral IOP assessment during follow-up of patients with unilateral RVO. The clinical importance of the relatively modest absolute changes remains uncertain, and longer studies are required to determine whether these changes predict glaucoma, recurrent RVO or vascular events in the fellow eye.

Limitations

The study had a relatively small sample size, particularly for the CRVO subgroup, and follow-up was limited to three months. The study excluded patients with glaucoma and those receiving IOP-altering treatment, limiting generalizability to some routine clinical populations. The study did not evaluate correlations between IOP and systemic vascular risk factors, ocular perfusion pressure, retinal ischemia, OCT/OCTA parameters or subsequent neovascular complications.

CONCLUSION

In patients with unilateral RVO, IOP was significantly higher in the affected eye than in the fellow eye at baseline, 1 month and 3 months. Affected-eye IOP increased significantly from baseline to 1 month and from baseline to 3 months, with relative stabilization thereafter. BRVO showed the most consistent longitudinal increase.

The fellow eye also demonstrated a significant increase in IOP, particularly in BRVO. These findings suggest that IOP changes may extend beyond the clinically affected eye and may reflect broader ocular or systemic vascular influences. Bilateral IOP monitoring, particularly during the early follow-up period, may therefore be clinically useful.

Ethics statement

The thesis records institutional ethics approval and written informed consent from all participants. Patient participation was voluntary and information was maintained confidentially for scientific purposes.

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Conflict of interest

No conflict of interest was reported in the thesis.

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REFERENCES

1. Frucht J, Shapiro A, Merin S. Intraocular pressure in retinal vein occlusion. *Br J Ophthalmol.* 1984;68(1):26-28. doi:10.1136/bjo.68.1.26.
2. Hayreh SS, Zimmerman MB, Beri M, Podhajsky P. Intraocular pressure abnormalities associated with central and hemicentral retinal vein occlusion. *Ophthalmology.* 2004;111(1):133-141. doi:10.1016/j.ophtha.2003.03.002.
3. Călugăru D, Călugăru M. Intraocular pressure modifications in patients with acute central/hemicentral retinal vein occlusions. *Int J Ophthalmol.* 2021;14(6):931-935. doi:10.18240/ijo.2021.06.20.
4. Ertop M, Yaylacioğlu Tuncay F, Aribas YK, Özdemir HB, Gürel G, Atılğan ME, Özdek Ş. Evaluation of central and peripheral retinal vascular changes in the fellow eyes of patients with unilateral retinal vein occlusions. *Turk J Ophthalmol.* 2023;53(6):349-355. doi:10.4274/tjo.galenos.2023.94389.
5. Beaumont PE, Kang HK. Cup-to-disc ratio, intraocular pressure, and primary open-angle glaucoma in retinal venous occlusion. *Ophthalmology.* 2002;109:282-286. doi:10.1016/S0161-6420(01)00922-8.
6. Barnett EM, Fantin A, Wilson BS, Kass MA, Gordon MO; Ocular Hypertension Treatment Study Group. The incidence of retinal vein occlusion in the Ocular Hypertension Treatment Study. *Ophthalmology.* 2010;117(3):484-488. doi:10.1016/j.ophtha.2009.08.022.
7. Faseela CC, Praveen CP. Intraocular pressure patterns in the eye with retinal venous occlusions: a comparative study. *Int J Pharm Clin Res.* 2024;16(2):608-612.
8. Aref AA, Scott IU, VanVeldhuisen PC, et al.; SCORE2 Investigator Group. Intraocular pressure in eyes with retinal vein occlusion compared with fellow eyes: Study of Comparative Treatments for Retinal Vein Occlusion 2 (SCORE2) Report 27. *Ophthalmology.* 2024.
9. Ansons AM, Clearkin L, Bryce I. Mechanisms leading to an acute rise in intraocular pressure in retinal vein occlusion. *Eye.* 1990;4:439-444. doi:10.1038/eye.1990.55.
10. Hayreh SS, March W, Phelps CD. Ocular hypotony following retinal vein occlusion. *Arch Ophthalmol.* 1978;96(5):827-833. doi:10.1001/archophth.1978.03910050433006.