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Clinical Patterns of Retinal Vein Occlusion in Addis Ababa, Ethiopia

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Abstract

Background: Retinal vein occlusion is an obstruction of the normal retinal venous system that typically occurs at the arteriovenous crossing or lamina cribrosa. It is the second most common retinal vascular disease following diabetic retinopathy.

Methods: This ophthalmic institution-based, cross-sectional study was conducted from November 2021 to October 2022. All consecutive new patients who visited the Menelik II Hospital Ophthalmology Department Retina Unit, Nisir Specialized Eye Clinic, and Biruh Vision Eye Care Center during the study period were included. The data were collected using a structured interviewer-administered tool. The collected data were coded and entered into Epi Data version 4.6 and analyzed using SPSS version 26.

Results: A total of 107 patients with retinal vein occlusion were enrolled; the mean age was 51.2 ± 11.7 years. Two-thirds of the patients were males (71 [66%]). Retinal vein occlusion was unilateral in 104 (97.2%) patients. Almost two-thirds of patients, 68 (64%), with retinal vein occlusion had central retinal vein occlusion. The most common anatomic location of branch retinal vein occlusion was the supertemporal region in 19 (79.1%) patients. Hypertension and glaucoma were the most frequent systemic and ocular risk factors, respectively, in 77 (68.2%) and 21 (19.6%) patients with retinal vein occlusion. The most common complication of retinal vein occlusion was macular edema (77, 72%).

Conclusion: Retinal vein occlusion was an important cause of monocular visual impairment in our study. Hypertension and glaucoma were the most common risk factors. We recommend that all new patients with retinal vein occlusion undergo a systemic evaluation.

Keywords: *Retinal Vein Occlusion; CRVO; BRVO; Clinical Patterns; Ethiopia*

Introduction

Retinal vein occlusion (RVO) is an obstruction of the normal retinal venous system that typically occurs at the arteriovenous crossing or lamina cribrosa [1]. It is the second most common retinal vascular disease following diabetic retinopathy [1,2].

There are three distinct types of RVO: branch retinal vein occlusion (BRVO), central retinal vein occlusion (CRVO), and an anatomical variant of CRVO, namely, hemi-central retinal vein occlusion (HCRVO) [2,4]. BRVO is three times more common than CRVO [1,2].

The precise mechanism underlying RVO is poorly understood. The pathogenesis of RVO is multifactorial. The condition may be due to a combination of three systemic changes known as Virchow's triad: hemodynamic changes (venous stasis), degenerative changes in the vessel wall, and blood hypercoagulability [9-11].

Systemic risk factors most commonly associated with RVO include advanced age, hypertension, diabetes mellitus, hyperlipidemia, and smoking. Ocular risk factors associated with RVO include glaucoma or ocular hypertension, shorter axial length, focal arteriolar narrowing, and arteriovenous nicking [12].

Complications of RVO include retinal ischemia, macular edema, neovascularization of the disc, retina, iris, and angle, and neovascular glaucoma. Macular edema is the most common cause of visual loss in RVO [5].

In Ethiopia, there has been an increase in the life expectancy of the population with systemic disorders such as hypertension and associated ocular disorders [13]. Hence, we expect an increase in the incidence of RVO and its associated visual morbidity. There are limited studies on the clinical profiles and associated factors of RVO in Ethiopia.

These findings may help identify high-risk individuals for screening and increase awareness of how to prevent visual impairment from RVO.

Methods

The study was conducted at the Menelik II Hospital Department of Ophthalmology Retina Clinic, Nisir Specialized Eye Clinic, and Biruh Vision Eye Care Center. Menelik II Hospital is a tertiary hospital located in Addis Ababa, Ethiopia. The department has subspecialties, including a retina clinic with three vitreoretinal subspecialists and four to five rotating ophthalmology residents.

The Nisir Specialty Eye Clinic and Biruh Vision Eye Care Center are private specialty eye care centers located in Addis Ababa, Ethiopia. These eye care centers are better equipped with retinal diagnostic and intervention facilities and are led by experienced vitreoretinal specialists. The study was conducted from November 2021 to October 2022.

A multicenter, ophthalmic institution-based, cross-sectional study was conducted. All consecutive new RVO patients who visited the Menelik II Hospital Ophthalmology Department Retina Clinic, Nisir Specialized Eye Clinic, and Biruh Vision Eye Care Center were included in the study.

Three eye care centers in Addis Ababa, Ethiopia, were selected using convenience sampling. We included 107 new patients with RVO: 51 patients from Menelik II Hospital, 30 from the Nisir Specialized Eye Clinic, and 26 from the Biruh Vision Eye Care Center.

The investigators and/or residents at the Menelik Hospital Retina Clinic, Nisir Specialized Eye Clinic, and Biruh Vision Eye Care Center identified patients with RVO, confirmed by vitreoretinal specialists. After obtaining informed verbal consent, data were collected from all consecutive new patients with RVO using interviewer-administered questionnaires that addressed sociodemographic characteristics, systemic risk-factor assessment, ophthalmic history, physical examination, and ophthalmic examination.

Vision was measured with the Snellen chart at 6 meters at Menelik II Hospital and at 3 meters at the Biruh Vision Eye Care Center and Nisir Specialized Eye Clinic, using an appropriate distance chart. In patients who could not see the target with Snellen's chart at 6 meters or 3 meters, vision was tested by counting fingers at the distance the patient could see. Light perception and hand motion were checked and recorded in patients who could not count fingers.

Intraocular pressure was measured first with an air-puff tonometer and then with an I-care tonometer to confirm that it was greater than 21 mm Hg. Anterior segment examination was performed using a slit lamp biomicroscope, and findings, including neovascularization of the iris and deposition of pseudoexfoliation material at the pupil and lens, were identified.

Dilated fundus examination was performed after applying 0.5% or 1% tropicamide to both the right and left eyes using a slit lamp biomicroscope coupled with a 90-diopter lens. The extent and type of retinal hemorrhage, cotton wool spots, dilated tortuous veins, optic nerve swelling, macular edema, and neovascularization of the retina or optic disc were documented. The laterality, type, and anatomic location of RVO were assessed and documented. The optometrists determined the patients' refractive status.

Blood pressure was measured at the nurses' clinics using a manual sphygmomanometer. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were recorded from the first and fifth Korotkoff sounds, respectively. Height in meters and weight in kilograms were measured using the ZT-120 model height and weight measurement scale by trained nurses, from which BMI was calculated.

Fasting blood sugar in mg/dl, total cholesterol in mmol/L, triglycerides in mmol/L, high-density lipoprotein (HDL) in mmol/L, creatinine in mmol/L, ESR, CBC, coagulation profile, and VDRL were measured when available as part of the routine investigation of the patient.

Macular OCT was performed in patients who could afford as part of routine clinical practice. The presence or absence of macular edema and central retinal thickness were documented. The reasons for patients who were unable to undergo laboratory investigations or macular OCT were identified. In patients with bilateral RVO, only one eye (the eye with more severe disease) was selected for analysis.

Close supervision of the data collection procedures and proper categorization and coding of the data were closely followed. The collected data were checked daily for accuracy and completeness. Data cleaning and checking were performed before analysis.

The data were checked for completeness and consistency, entered into Epidata 4.6, and then exported and analyzed using SPSS version 26. Continuous variables were described using the mean and standard deviation, and some continuous data, such as age, were categorized into age groups for comparison between the groups. HCRVO and CRVO were categorized as CRVO for bivariate and multivariate analysis. Categorical data are presented as frequencies and percentages. Binary logistic regression analysis with odds ratios (ORs) and 95% confidence intervals (CIs) was used to assess the associations between dependent and independent variables. Variables with a p-value < 0.2 were entered into the multivariate analysis. The final findings were reported using adjusted odds ratios (AORs) and 95% CIs. A p-value of less than 0.05 indicated statistical significance in the multivariable model.

Ethical approval to conduct the study was obtained from the Department of Ophthalmology, College of Health Sciences, Addis Ababa University, the ethical review board. Participation was voluntary. Upon examination, management was given as recommended by a vitreoretinal subspecialist for individuals with apparent disease manifestations.

Results

There were 107 patients; 70 (66%) were males, aged 26 to 87 years, with a mean age of 56.2 ± 11.7 years. Among all RVO patients, 104 (97.2%) had unilateral RVO. Nearly two-thirds (64%) of the RVO patients had CRVO. The most common anatomic location of BRVO was the supertemporal region in 19 (79.1%) patients. (Table 1).

Variables	Categories	Frequency	Percent
Eye involved	Right	42	39.3
	Left	62	57.9
	Bilateral	3	2.8
Location of HCRVO	Superior	7	46.7
	Inferior	8	53.3
Location of BRVO (quadrant)	Supero- temporal	19	79.1
	Infero-temporal	3	12.5
	Supero-nasal	1	4.2
	Infero-nasal	1	4.2

Table 1: *Location and laterality of RVO in the selected eye care centers of Addis Ababa, Ethiopia, from November 2021 to October 2022, n = 107.*

More than half of the patients, 57 (53.8%), had a history of hypertension. None of the female patients was pregnant or used oral contraceptive pills at the time of presentation (Table 2).

Variables Categories		Frequency	Percent
History of hypertension	Yes No	57 49	53.8 46.2
Duration of hypertension	< 1 yr. 1 - 5 yrs. > 5 yrs.	9 30 16	16.4 54.5 29.1
History of DM	Yes No	31 75	29.8 70.2
Duration of DM	< 1 yr. 1 - 5 yrs. > 5 yrs.	3 9 18	10 30 60
History of cardiac disease	Yes No	1 106	0.9 99.1
History of stroke	Yes No	1 106	0.9 99.1
Regular exercise	Yes No	29 78	27.1 72.9
Smoking	Yes No	6 101	5.6 94.4

Table 2: *History of systemic illness and personal habits in patients with RVO in selected eye care centers in Addis Ababa, Ethiopia, from November 2021 to October 2022 (n = 107).*

Hypertension was found in 37 (55.2%) CRVO patients and 7 (46.7%) HCRVO patients. Smoking was found only in CRVO patients (8.8%) (Table 3).

Variables	Categories	Types of RVO n(%)		
		CRVO*	HCRVO**	BRVO⁂
Age in yrs.	≤ 50 yrs.	24 (35.3)	4 (26.7)	7 (29.2)
	>50	42 (64.7)	11 (73.3)	17 (70.8)
HTN	Hypertensive	37 (55.2)	7 (46.7)	13 (54.2)
	Normal	30 (44.8)	8 (53.3)	11 (45.8)
DM	Present	24 (35.8)	1 (6.7)	6 (25)
	Absent	43 (64.2)	14 (93.3)	18 (75)
History of cardiac disease	Yes	1 (1.5)	0	0
	No	67 (98.5)	15 (100)	24 (100)
History of stroke	Yes	1 (1,5)	0	0
	No	67 (98.5)	15 (100)	24 (100)
Regular exercise	Yes	18 (26.5)	2 (13.3)	9 (37.5)
	No	50 (73.5)	13 (86.7)	15 (62.5)

Smoking	Yes	6 (8.8)	0	0
	No	62 (91.2)	15 (100)	24 (100)
BMI	Underweight	5 (7.3)	1 (6.7)	2 (8.3)
	Normal range	27 (39.7)	6 (40)	8 (33.3)
	Overweight	17 (25)	3 (20)	9 (37.5)
	Obese	19 (28)	5 (33.3)	5 (20.8)
Glaucoma	Present	14 (20.6)	3 (20)	4 (16.7)
	Absent	54 (79.4)	12 (80)	20 (83.3)

Table 3: *Frequency and percentage of risk factors among different types of RVO in selected eye care centers in Addis Ababa, Ethiopia from November 2021 to October 2022 (n = 107).*

** (n = 68), **(n = 15), ⁂ (n = 24).*

The majority of patients (102, 95.4%) complained of decreased vision. The mean duration of presentation was 5.6 ± 9.1 months. Approximately 21 (19.6%) patients had a history of glaucoma (Table 4).

Variables Categories		**Frequency**	**Percent**
Presenting compliant	Decrease in vision	102	95.4
	Pain	1	0.9
	No complaint	4	3.7
Duration of presentation	< 1 month	25	23.7
	1 - 3 months	45	42.1
	>3 months	37	34.6
History of ocular surgery	Yes	5	4.7
	No	102	95.3
Glaucoma	Yes	21	19.6
	No	86	80.4

Table 4: *Ophthalmic history of patients with RVO in the selected eye care center of Addis Ababa, Ethiopia, from November 2021 to October 2022; n = 107.*

Hypertension, obesity, and moderate visual impairment or worse were found in 73 (68.2%), 13 (12.1%), and 87 (83.7%) patients, respectively (Table 5).

Variables	**Categories**	**Frequency**	**Percent**
BP	Normal range	34	31.8
	Hypertensive	73	68.2
BMI	Underweight	7	6.5
	normal range	50	46.8
	overweight	37	34.6
	obese	13	12.1

Visual acuity	Normal range	10	9.3
	Mild VI	10	9.3
	Moderate VI	35	32.7
	Severe VI	20	18.7
	Blindness	32	29.9
IOP	Normal range High IOP	82 25	76.6 23.4

Table 5: *Physical and ophthalmic measurements in patients with RVO in the selected eye care centers of Addis Ababa, Ethiopia, from November 2021 to October 2022 (n = 107).*

On fundus examination, macular edema was found in 77 (72%) patients.

Neovascularization of the disc was the most common neovascular complication among CRVO patients (5, 7.4%) and HCRVO patients (4, 26.7%).

The creatinine levels were within the normal range in all 22 patients for whom the test was performed. The VDRL was positive in only one of the six patients tested. ANA was negative in all three tested patients. The PT, PTT, and INR were within the normal ranges in the two tested patients. OCT was performed in 63 patients; 58 (92.1%) patients had macular edema with a mean central retinal thickness of 543 micrometers.

Most patients did not complete laboratory or imaging studies because of financial constraints. Tests such as ANA, ANCA, OCT, and coagulation profiles were unavailable at Menelik Hospital during the study period. Other tests were available but not consistent throughout the study due to a lack of reagents. OCT was available at the Nisir Eye Specialized Clinic and Biruh Vision Eye Care Center; laboratory tests were not available at either center during the study period.

Multivariate logistic regression analysis revealed no significant differences in sociodemographic characteristics, potential risk factors, or other clinical patterns between patients with CRVO and those with BRVO (Table 6).

Variables	**Categories**	**Types of RVO**		**COR (95%CI)**	**P- value**	**AOR (95% CI)**	**P-value**
		CRVO	**BRVO**				
Age in yrs.	≤ 50	28	7	1			
	>50	53	17	.78 (.28 - 2.10)	.62		
Sex	Male	56	14	1.5 (.64 - 3.92)	.37		
	Female	26	10	1			
Hypertension	Hypertensive	56	15	.98 (.39 - 2.4)	.97		
	Normal	25	9	1			
DM	Present	25	6	1.32 (.47 - 3.7)	.60		
	Absent	57	18	1			
Regular exercise	Yes	20	9	.53 (.20 - 1.39)	.20		
	No	63	15	1			

Glaucoma	Yes	15	4	1.2 (.38 - 4.43)	.68		
	No	58	12	1			
Visual acuity	Moderate VI or better	39	16	1			
	Severe VI or worse	43	8	2.39 (.92 - 6.2)	.07*	.55 (.18 - 1.65)	.28
Pseudo exfoliation	Yes	12	3	1.19 (.31 - 4.65)	.80		
	No	67	20	1			
Cotton wool spots	Present	44	9	1.90 (.74 - 4.90)	.18*	.71 (.25 - 2.00)	.52
	Absent	36	14	1			
Macular edema	Present	63	14	3.37 (1.19 - 9.5)	.02*	2.12 (.14 - 1.32)	.14
	Absent	12	9	1			

Table 6: *Bivariate and multivariate logistic regression analysis of CRVO and BRVO patients in selected eye care centers in Addis Ababa, Ethiopia, from November 2021 to October 2022 (n = 107).*

**Candidate variables for multivariate analysis (p value < 0.2).*

Discussion

In this study, the mean age of the RVO patients was 56.2 ± 11.7 years, slightly higher than that reported in a study in India (51.8 years) [18]. RVO was found in older populations because of an increase in associated cardiovascular comorbidities such as hypertension, which is a major risk factor for RVO. The mean age at presentation was younger in our study than in other studies in Australia (63 yrs.). and Nigeria (58 ± 10.1 yrs.) [19,20]. The younger mean age at presentation in our study may be due to patients not recalling the exact birth date and to the national registry of birth dates not being well developed. Two-thirds of the patients were male (71, 66%), which was similar to findings from studies in India, Germany, and Japan [18,21,22]; in contrast, a study in Nigeria reported more female RVO patients than male RVO patients [23]. A study in Korea showed equal prevalence among males and females [16]. The greater number of male RVO patients in our study could be explained by more male patient admissions from the patriarchal privilege of men to move and obtain care, and the economic independence of males in the family.

We found that 104 (97.2%) patients with RVO had unilateral disease. Sixty-two eyes were involved in the left eye (57.9%), which was nearly the same as that reported in the Blue Mountain Eye Study in Australia [20]; 21 (63.6%) of 33 eyes were involved in the left eye [19]. There is no reason for the greater involvement of the left eye.

Nearly two-thirds of RVO patients (64%) had CRVO, followed by BRVO and HCRVO, findings similar to those of hospital-based studies in Nigeria and Ethiopia [20,23,24]. However, most population studies have shown that CRVO is more common than BRVO [16,19,22,25]. This may be because most patients with CRVO have decreased visual acuity and may visit eye care centers. Patients with BRVO, although more common in the population, might not visit eye care centers because of sectoral retinal involvement.

BRVO was found to be most common in the supero-temporal quadrant (19, 79.1%), followed by the infero-temporal quadrant (3, 12.5%), consistent with the Beaver Dam Eye Study in the USA [26]. The increased incidence of BRVO in the supero-temporal quadrant is thought to be related to increased arteriovenous crossing in the supero-temporal quadrant relative to other quadrants [26].

In our study, most of the patients with RVO had hypertension (73, 68.2%), similar to most studies on RVO [16,20,22,23,26]. Hypertension can damage retinal veins, leading to thrombosis at the site of the lamina cribrosa in patients with CRVO. In BRVO, hypertension will narrow and thicken branch retinal arteries, leading to the compression of branch retinal veins, which subsequently causes stasis and thrombus formation [9].

In this study, 31 (29.8%) patients had a history of diabetes mellitus, which is higher than that reported in most studies [22,26,27]. Diabetes has been found to be a risk factor for RVO in many studies [12,26,28], whereas in other studies, diabetes mellitus was not a significant risk factor for RVO [16,21]. Diabetes mellitus causes endothelial damage or abnormal blood flow, leading to thrombosis that ultimately results in retinal vein occlusion [29].

We found that the majority of patients with RVO presented to eye care centers with a decrease in vision of 102 (95.4%), and one patient presented with pain and was diagnosed with neovascular glaucoma. Our study's mean symptom duration at presentation was 5.6 ± 9.1 months, comparable to that in the study by Nwusu in Nigeria, in which the mean duration of symptoms was 5 months [20]. The delay in the presentation may be due to the lack of availability of eye care centers in nearby areas, the low economic status of patients, low health education, lack of awareness, and good vision in the fellow eye, which may mask the affected eye from seeking attention.

Twenty-one (19.6%) patients with RVO had a history of glaucoma, comparable with a study by Sharma., *et al*. in which 16% of RVO patients were affected [18]. It has been suggested that increased IOP or glaucoma may lead to compression of the central retinal vein at the site of the lamina cribrosa, and loss of the retinal nerve fiber layer in glaucoma leads to compression of retinal arteries over veins, leading to blood stasis and thrombosis.

Most RVO patients in our study had moderate visual impairment or worse (85 [79.4%]), resulting from macular edema. The most common complication of RVO in our study was macular edema in 77 (72%) patients. The other complications included neovascularization of the iris in 3 patients (2.8%), vitreous hemorrhage in 3 patients (2.8%), neovascularization of the retina in 5 patients (4.7%), neovascularization of the disc in 10 patients (9.3%), and neovascular glaucoma in 1 patient. Neovascularization in various ocular structures is thought to result from ischemia, primarily via increased vascular endothelial growth factor [30]. Macular edema was found to be more frequent at presentation in several studies [31,32], while a hospital-based study by Fiebai., *et al*. revealed that the most frequent complication was vitreous hemorrhage (52.6%) [23].

Four of the 13 patients whose lipid profiles were measured had hyperlipidemia. Although our study included a small sample size for analysis, hyperlipidemia was not found to be a significant risk factor in the Blue Mountain Eye Study, a population-based study in Australia [19]; in contrast, hyperlipidemia was significantly associated with RVO in a population-based study in Korea [16].

OCT was performed in 63 patients; macular edema was found in 58 (92.1%) patients, with a mean central retinal thickness of 543 micrometers. In most patients seen at Menelik II Hospital, OCT imaging was not performed because it was unavailable during the study period, and patients could not afford referral imaging at private centers. Almost all Biruh Vision Eye Care Center and Nisir Specialized Eye Clinic patients underwent OCT imaging.

Our study revealed no significant differences in sociodemographic characteristics, potential risk factors, or other clinical patterns between patients with CRVO and those with BRVO. This finding was similar to that of the study by Feibai., *et al*. [23]. This may be attributed to the shared pathogenesis of RVO.

As a limitation, convenient sampling was used, which may limit the generalizability of the findings to all eye care centers in Addis Ababa and the general population in Addis Ababa. Laboratory tests and OCT were not performed; the absence of OCT may underestimate mild macular edema that may not be clinically detected.

Conclusion

RVO was an important cause of monocular visual impairment in our study, causing moderate or worse visual impairment in most patients. RVO was found to affect older age groups. The most common type of RVO was CRVO, followed by BRVO and HCRVO. Hypertension and glaucoma were the most frequent systemic and ocular risk factors observed in patients with RVO, respectively. Macular edema was the most common ocular complication of RVO.

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Availability of Data and Materials

All relevant data are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

Ethical approval was obtained from the Ophthalmology Department of Addis Ababa University research and publication committee on 15/09/2021 with reference letter number OREC/006/21.

Consent for Publication

Not applicable as there was no confidential data or photo of the participants.

Conflict Interests

The authors declare that they have no conflict interests.

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