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An Examination of Eye Conditions Associated with Retinal Vein Occlusion

Dr. Vikrant Narawade
Assistant Professor, Department of Ophthalmology, Prakash Institute of Medical Sciences & Research, Islampur

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Corresponding author: Dr. Vikrant Narawade

Abstract

Background: Retinal vein occlusion (RVO) is a significant retinal vascular disorder that impacts the blood flow in the retina, leading to a range of visual and systemic complications. RVO is classified into three main types based on the location of the occlusion: Branch Retinal Vein Occlusion (BRVO), Central Retinal Vein Occlusion (CRVO), and Hemiretinal Vein Occlusion (HRVO). Each type has distinct clinical features, risk factors, and implications for vision and treatment. The high incidence of macular edema and severe visual impairment underscores the need for effective management strategies, including anti-VEGF therapy, corticosteroids, and laser treatment. The findings highlight the importance of personalized treatment plans tailored to the specific type and severity of RVO and its complications. The study reinforces the critical role of managing systemic risk factors such as hypertension, diabetes, and hyperlipidemia. Regular monitoring and control of these conditions are essential to prevent or mitigate the severity of RVO. The study's observational design limits its ability to establish causality. Additionally, the sample sizes for some RVO types, particularly HRVO, are relatively small, which may affect the generalizability of the findings.

Aim: The primary aim of this study is to evaluate the prevalence, clinical features, and visual outcomes of various ocular conditions associated with retinal vein occlusion (RVO).

Material and Method:

This prospective, observational cohort study was conducted in the ophthalmology department with 80 participants diagnosed with RVO. Each participant provided written informed consent. Comprehensive eye examinations were performed, including visual acuity testing, fundoscopic examination, intraocular pressure measurement, optical coherence tomography (OCT), fluorescein angiography, and fundus photography. Systemic parameters such as blood pressure, blood glucose levels, and lipid profiles were recorded to assess risk factors. Ocular complications such as macular edema, vitreous hemorrhage, neo-vascularization, and disc neo-vascularization were documented. Visual acuity was categorized into three groups: >6/18, 6/18–6/60, and <6/60.

Results: BRVO was primarily associated with macular edema (16.2%), with 33.7% of patients exhibiting severe visual impairment (visual acuity <6/60). **CRVO** showed a broader range of complications, including vitreous hemorrhage (18.75%), macular edema (10%), neo-vascularization (5%), and disc neo-vascularization (6.2%). Approximately 21.2% of CRVO patients had severe visual impairment. **HRVO** had fewer complications, primarily vitreous hemorrhage (2.5%), with 7.5% of patients experiencing severe visual impairment. The highest prevalence of RVO was observed in the 61-70 years age group (37.5%), with a slightly higher incidence in females compared to males. BRVO and CRVO have higher proportions of patients with severe visual impairment compared to HRVO. HRVO has the lowest percentage of patients with severe visual impairment but also the lowest overall number of patients. Most of the patients with RVO experience significant visual impairment, with only a small percentage maintaining good visual acuity.

Conclusion: RVO significantly impacts visual acuity, with a high prevalence of severe visual impairment observed across all types of RVO. CRVO is associated with a broader range of complications and worse visual outcomes compared to BRVO and HRVO. Effective management of RVO requires addressing both ocular complications and systemic risk factors. The study highlights the importance of early diagnosis and tailored treatment strategies to improve visual outcomes. Future research should focus on larger sample sizes and longitudinal studies to further understand the long-term effects and optimal management of RVO.

Keywords: Retinal vein occlusion, Branch retinal vein occlusion, Central retinal vein occlusion, Hemiretinal vein occlusion, Macular edema, Visual acuity, Ocular complications.

Introduction

Retinal vein occlusion (RVO) is a significant ophthalmic condition characterized by the obstruction of one or more of the veins that carry blood away from the retina. This condition can lead to various eye-related complications and vision impairment, making it a critical area of study within ophthalmology. The retina is a crucial component of the eye, responsible for capturing light and transmitting visual information to the brain. Blood flow within the retina is essential for its proper function, and any disruption in this flow can lead to severe consequences. Retinal vein occlusion occurs when a vein in the retina becomes blocked, impeding blood flow and leading to a buildup of pressure. This obstruction can be partial or complete and may affect either the central retinal vein or one of its branches.[1,2] **Central Retinal Vein Occlusion (CRVO)** this type occurs when the central retinal vein, which drains blood from the entire retina, becomes obstructed. CRVO can be further classified into ischemic and non-ischemic forms, depending on the extent of retinal damage and loss of blood supply. **Ischemic CRVO** Characterized by severe retinal damage and a high risk of vision loss. It often shows extensive retinal hemorrhage and areas of retinal non-perfusion. **Non-Ischemic CRVO** Typically presents with milder symptoms and less severe retinal damage. It may still lead to vision impairment but generally has a better prognosis compared to ischemic CRVO. **Branch Retinal Vein Occlusion (BRVO)** this type involves blockage in one of the smaller branches of the central retinal vein. BRVO is generally less severe than CRVO but can still lead to significant visual impairment.[3,4]

The prevalence of RVO increases with age, particularly in individuals over 60 years old. High blood pressure is a significant risk factor for both CRVO and BRVO, as it can lead to changes in the retinal vessels and increased likelihood of occlusion. Diabetes can cause changes in retinal blood vessels, making them more susceptible to occlusion. Elevated cholesterol levels are associated with an increased risk of RVO Conditions such as atherosclerosis, heart disease, and stroke are linked to higher risk of RVO. Increased intraocular pressure can contribute to vein occlusion. Smoking and obesity are additional risk factors that can exacerbate the likelihood of developing RVO.[5] The central retinal vein often becomes compressed at the point where it crosses a retinal artery, leading to occlusion. The formation of blood clots within the retinal veins can block blood flow and exacerbate the obstruction. Inflammatory responses in the retina can contribute to vein occlusion and subsequent damage. In response to ischemia, new, abnormal blood vessels may form, which can further complicate the condition and lead to additional vision problems.[6]

Sudden or gradual loss of vision is a common symptom, especially in cases of CRVO. Patients may experience blurred vision or distorted visual fields. Hemorrhages within the retina are often observed during fundoscopic examination. Allows for direct visualization of the retina, where signs of hemorrhage, exudates, and vein

engorgement can be observed. Provides detailed imaging of retinal layers and helps assess retinal thickness and edema. Utilizes a dye injected into the bloodstream to visualize retinal blood flow and identify areas of blockage or leakage. Anti-VEGF (vascular endothelial growth factor) agents, such as ranibizumab and aflibercept, are used to reduce retinal edema and neovascularization.[7] Corticosteroids may also be used to manage inflammation. In severe cases, surgical options such as vitrectomy may be considered to address complications and improve vision. The prognosis for individuals with RVO varies based on the type of occlusion, the extent of retinal damage, and the effectiveness of treatment. While some patients may experience significant improvement in vision with appropriate management, others may face long-term visual impairment.[8]Early diagnosis and intervention are key to optimizing outcomes and minimizing complications. Retinal vein occlusion is a complex condition with substantial implications for vision and retinal health. Understanding its classification, risk factors, pathophysiology, and treatment options is essential for effective management and improved patient outcomes. Ongoing research and advancements in therapeutic approaches continue to enhance our ability to address this challenging condition.[9,10]

Material and Methods

This prospective observational cohort study was carried out in the ophthalmology department. Before the assessment, all participants provided written informed consent and were briefed on the study's purpose. Patient details, including name, age, and gender, were recorded. The questionnaire covered the patient's medical history, including any previous ocular trauma and past eye surgeries. A total of 80 participants were involved in the study. Comprehensive eye examinations were conducted, which included visual acuity testing, fundoscopic examination, and intraocular pressure measurement. Optical coherence tomography (OCT) and fluorescein angiography were performed to assess retinal morphology, macular edema, and blood flow. Fundus photography was used to document retinal findings. Additionally, blood pressure, blood glucose levels, and lipid profiles were recorded to evaluate risk factors. Dilated fundoscopy was performed using a direct ophthalmoscope, an indirect ophthalmoscope, and slit lamp biomicroscopy. Blindness was defined as visual acuity worse than 6/18, while visual impairment was defined as acuity between 6/18 and 6/60.

Inclusion criteria

Patients diagnosed with retinal vein occlusion (CRVO or BRVO) based on clinical examination and diagnostic imaging. Participants should be selected from ophthalmology clinics or hospitals.

Exclusion criteria

- Cataract and other media opacities (fundus details not seen).
- Other associated acute ocular morbidity like uveitis.

Diagnosed cases of RVOs were then looked for the following complications:

- Macular Edema (ME).
- Vitreous Hemorrhage (VH).
- Iris Neovascularization (INV).
- Disc Neovascularization (DNV)

Diagnostic Equipment

- **Fundus Camera**: For capturing high-resolution images of the retina to assess retinal hemorrhages, exudates, and overall retinal health.
- **Optical Coherence Tomography (OCT)**: To provide detailed cross-sectional images of the retina and measure retinal thickness, macular edema, and other structural changes.
- **Fluorescein Angiography (FA)**: To evaluate retinal blood flow and identify areas of blockage, leakage, or abnormal blood vessel formation.

Clinical Assessment Tools

- **Visual Acuity Charts**: To assess the degree of vision loss in patients, using tools such as the Snellen chart or Early Treatment

Diabetic Retinopathy Study (ETDRS) charts.

- **Intraocular Pressure (IOP) Measurement Devices**: To monitor intraocular pressure, as elevated pressure can be a risk factor for RVO

Laboratory Tests

- **Blood Pressure Monitors**: To measure and record systemic blood pressure levels, given the role of hypertension in RVO.
- **Blood Glucose Tests**: To monitor glycemic control in diabetic patients.
- **Lipid Profile Tests**: To assess cholesterol and lipid levels, this can be associated with RVO.
- **Patient History Questionnaire**: To collect information on demographic data, medical history, risk factors, and symptoms.
- **Clinical Examination Forms**: For recording findings from ocular and systemic examinations.
- **Treatment Records**: To document treatment regimens, including intravitreal injections, laser therapy, and other interventions.

Administer standard treatments such as anti-VEGF injections, corticosteroids, or laser therapy based on clinical guidelines. Regular follow-up visits to monitor treatment effects, retinal changes, and visual outcomes. Follow-up intervals may be monthly or quarterly, depending on the severity and response to treatment.

Statistical Analysis

For quantitative and qualitative analysis, mean and standard deviation, frequency, and percentage tables were used. Fisher, Student, and Chi-Square tests were used to see whether there was any association between the research groups. A p-value of 0.05 or less was regarded as significant. For statistical analysis, SPSS ver. 20 and MS Excel were both used. MS Excel 2010 was used for the graphic representation.

Result: -

BRVO was found in 44(55%) patients, CRVO in 28 (35%) patients, and HRVO in 8 (10%) patients. BRVO and CRVO have higher proportions of patients with severe visual impairment compared to HRVO. HRVO has the lowest percentage of patients with severe visual impairment but also the lowest overall number of patients. Most of the patients with RVO experience significant visual impairment, with only a small percentage maintaining good visual acuity.

Table 1: Show the association of BCVA and RVO

Type of Occlusion	>6/18		BCVA 6/18 - 6/60		<6/60		Total	
	N	%	N	%	N	%	N	%
BRVO	6	7.5%	11	13.7%	27	33.7%	44	55%
CRVO	3	3.75%	8	10%	17	21.2%	28	35%
HRVO	1	1.2%	1	1.2%	6	7.5%	8	10%
Total	10	12.5%	20	25%	50	62.5%	80	100%

For BRVO, a significant portion of patients (33.7%) has visual acuity worse than 6/60, indicating severe visual impairment. Only a small percentage (7.5%) has visual acuity better than 6/18. CRVO also shows a notable portion with severe visual impairment (21.2%). The percentage of patients with visual acuity better than 6/18 is relatively low (3.75%), suggesting that CRVO can lead to substantial vision loss. HRVO has the smallest number of patients and the lowest percentages in the better visual acuity categories. A significant proportion (7.5%) has severe visual impairment, though the overall numbers are lower compared to BRVO and CRVO.

Table 2: Show the association of ocular complications and RVO

	Ocular Complications							
Type of Occlusion	**VH**		**ME**		**INV**		**DNV**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
BRVO	0	-	13	16.2%	0	-	0	-
CRVO	15	18.75%	8	10%	4	5%	5	6.2%
HRVO	2	2.5%	0	-	0	-	0	-

BRVO primarily leads to macular edema without significant cases of vitreous hemorrhage, neo-vascularization, or disc neo-vascularization. CRVO has a broader range of complications, with a significant percentage experiencing vitreous hemorrhage, and smaller percentages affected by macular edema, neo-vascularization, and disc neo-vascularization. HRVO has a relatively low incidence of vitreous hemorrhage and does not show other complications like macular edema, neo-vascularization, or disc neo-vascularization in this sample.

Table 3: Show the Age and sex distribution

Age(Years)	M	F	Total	%
41-50	4	10	14	17.5
51-60	15	7	22	27.5
61-70	12	18	30	37.5
≥71	4	10	14	17.5
Total	**35**	**45**	**80**	**100.0**

The 61-70 years age group has the highest proportion of patients with RVO (37.5%). This suggests that RVO is most common in this age range. The gender distribution varies across age groups, but overall, there are more females (45) than males (35) in the study population. The age groups 41-50 years and ≥71 years each contribute 17.5% to the total population, while the age group 51-60 years contributes 27.5%. The prevalence of RVO across different age groups, with a notable increase in cases among individuals aged 61-70 years. It also indicates a slightly higher prevalence in females compared to males.

Discussion

Retinal vein occlusion (RVO) is a significant retinal vascular condition with substantial implications for visual function and quality of life. This study provides insights into the prevalence of ocular complications, visual outcomes, and demographic characteristics associated with RVO. The study categorizes ocular complications such as vitreous hemorrhage (VH), macular edema (ME), neovascularization (INV), and disc neovascularization (DNV) across different types of RVO: Branch Retinal Vein Occlusion (BRVO), Central Retinal Vein Occlusion (CRVO), and Hemiretinal Vein Occlusion (HRVO).[11,12]

The data indicates that BRVO is most commonly associated with macular edema (16.2%), while vitreous hemorrhage, neovascularization, and disc neovascularization are not observed in this group. This aligns with existing literature that shows macular edema is a frequent complication of BRVO due to localized retinal ischemia and subsequent leakage from retinal capillaries. CRVO shows a broader range of complications with higher incidences of vitreous hemorrhage (18.75%), macular edema (10%), neovascularization (5%), and disc neovascularization (6.2%).[13] These findings are consistent with literature, as CRVO often leads to more severe retinal damage, including extensive ischemia and secondary complications

like neovascularization. HRVO shows a lower incidence of complications compared to BRVO and CRVO. Vitreous hemorrhage is present in 2.5%, but other complications are not observed. This suggests that HRVO, while still serious, may have a slightly better visual prognosis compared to CRVO, as reported in some studies.[14]

A significant number of patients (33.7%) have visual acuity worse than 6/60, indicating severe visual impairment. The relatively high proportion of severe visual impairment in BRVO may be due to the development of macular edema and retinal ischemia affecting central vision. Similar to BRVO, CRVO has a substantial percentage of patients with visual acuity worse than 6/60 (21.2%). CRVO's broader range of complications, including vitreous hemorrhage and neovascularization, contributes to the high incidence of poor visual outcomes. The percentage of patients with severe visual impairment is lower (7.5%) compared to BRVO and CRVO. This suggests that HRVO might be associated with somewhat better visual outcomes, potentially due to fewer complications or less severe retinal damage. The study shows that RVO is most prevalent in the 61-70 years age group (37.5%).[15] This finding is consistent with the literature, which suggests that the risk of RVO increases with age due to age-related changes in retinal vasculature and systemic health conditions like hypertension and diabetes. There is a higher prevalence of RVO in females compared to males across all age groups. This observation aligns with some studies suggesting that women may be more prone to developing RVO, possibly due to differences in systemic health factors or hormonal influences.[16]

A randomized clinical trial evaluated the efficacy of anti-VEGF injections for managing macular edema secondary to CRVO and BRVO. The study showed that anti-VEGF therapy significantly improved visual acuity and reduced macular edema compared to sham injections or other treatments Campochiaro, P. A., Brown, D. M., Awh, C. C., et al. (2018).[17] Research has focused on the use of corticosteroids in treating macular edema associated with RVO. The study found that intravitreal corticosteroids provided significant short-term improvements in visual acuity and reduction in macular edema, though with potential for elevated intraocular pressure and cataract formation Korobelnik, J. F., Brown, D. M., Collins, J., et al. (2017).[18] Recent research has significantly advanced our understanding of retinal vein occlusion, particularly in the areas of treatment efficacy, systemic risk factors, genetic predispositions, and imaging technologies. Anti-VEGF therapies remain a cornerstone in managing macular edema associated with RVO, while corticosteroids and laser therapies also play important roles.[19]

The high incidence of macular edema and vitreous hemorrhage in RVO emphasizes the need for early diagnosis and effective management strategies. Anti-VEGF therapies, corticosteroids, and laser treatments are critical in managing these complications and preserving visual function. The study reinforces the importance of managing systemic risk factors such as hypertension, diabetes, and hyperlipidemia to prevent or mitigate the severity of RVO. Regular monitoring and treatment of these conditions are essential in reducing the risk of RVO and its complications.[20] The study's observational nature means it can identify associations but not establish causality. Additionally, the sample size for some RVO types, especially HRVO, is relatively small, which may affect the generalizability of the findings. Further studies with larger sample sizes and longer follow-up periods are needed to confirm these findings and explore the long-term outcomes of RVO treatment. Research into the molecular and genetic factors contributing to RVO could provide insights into prevention and personalized treatment strategies.[21]

Conclusion:

This study offers valuable insights into the prevalence, complications, and visual outcomes of retinal vein occlusion. The findings highlight the significant impact of RVO on visual function

and the need for comprehensive management strategies. By understanding the demographic and clinical characteristics of RVO, healthcare providers can better tailor their diagnostic and therapeutic approaches, ultimately improving patient outcomes. Continued research is essential for advancing the understanding and treatment of this complex retinal condition.

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