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Original Research Article

A Hospital Based Observational Study to Access the Clinic-Demographic Profile and Outcome of Retinal Vein Occlusion in Diabetic Patients

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Abstract:

Background: Retinal vein occlusion (RVO) is the second most common retinal vascular disorder after diabetic retinopathy and a significant cause of visual impairment, particularly in individuals with diabetes mellitus.

Aim: This study aimed to evaluate the systemic and ocular risk factors associated with RVO in diabetic patients and to assess their visual prognosis following treatment.

Methods: A hospital-based observational study was conducted on 100 diabetic patients diagnosed with RVO. Detailed demographic, clinical, and systemic data were collected. All patients underwent comprehensive ocular examinations including best-corrected visual acuity (BCVA), optical coherence tomography (OCT), and fluorescein angiography where indicated. Visual outcomes were assessed at baseline and after a 3-month follow-up period. Multivariate logistic regression was used to identify independent predictors of poor visual prognosis.

Results: The mean age of the participants was 61.4 ± 8.9 years, with a male predominance (58%). Branch RVO was the most common subtype (62%), and macular edema was present in 68% of cases. Systemic comorbidities included hypertension (77%), poor glycemic control (HbA1c > 7.0%) in 81%, and hyperlipidemia (53%). At follow-up, 71% of patients showed visual improvement. Ischemic RVO, macular edema, and HbA1c > 8% were independently associated with poor visual outcomes.

Conclusion: RVO in diabetic patients is strongly associated with systemic vascular comorbidities. Early detection, prompt ophthalmologic management, and strict metabolic control are essential for improving visual outcomes in this high-risk population.

Keywords: Diabetes Mellitus, Macular Edema, Retinal Vein Occlusion, Risk Factors, Visual Prognosis.

Introduction

Retinal vein occlusion (RVO) is regarded as the second most common retinal vascular disease next to diabetic retinopathy [1] and it is a significant cause of vision loss, especially in older adults and patients with systemic vascular disease. RVO describes several forms of retinal vascular obstruction, primarily central retinal vein occlusion (CRVO), branch retinal vein occlusion (BRVO), and hemicentral retinal vein occlusion (HRVO). The commonality across each of these forms of occlusion is the location and extent of the venous obstruction(s) [2]. The risk of RVO is significantly increased in patients with diabetes mellitus due to the systemic vascular disease that accompanies chronic hyperglycemia, such as endothelial dysfunction, increased blood viscosity and advanced atherosclerosis, retinopathy, among others. Uncontrolled diabetes can be an important predisposing factor for both microvascular and macrovascular complications [3]. The sustained hyperglycemia leads to damage to the retinal microvasculature, increasing the potentiality of occlusion events [4]. In patients with diabetes, RVO exacerbates the development and progression of diabetic retinopathy and adds a layer of difficulty to management due to overlapping pathology [5]. In particular, when other comorbidities such as hypertension, dyslipidemia or renal disease exist, the likelihood of retinal vascular occlusion is further increased.

There are multiple variables that affect visual prognosis in patients with RVO, including the type of occlusion (CRVO has a worse visual prognosis than BRVO), the existence of macular edema, baseline visual acuity, as well as timing and effectiveness of the treatment interventions (intravitreal anti-VEGF agents or intravitreal corticosteroid injections).

RVO in diabetes patients presents further complicating factors due to the risk of recurrent occlusions, persistent macular edema, and poor vascular autoregulation, especially during the acute phase [6]. Population studies, whether in Nepal, China, Nigeria, or Denmark, have commonly identified the underlying role of systemic comorbidities within RVO; studies that link comorbidities with RVO and other ocular health have also been common [7]. While many of the studies are likely unimpaired by their general methodology, none of these studies explicitly explores the subpopulation of these patients; specifically, patients with diabetes who may be amongst the highest risk group. However, most of these studies do not distinctly evaluate the subpopulation of diabetic patients who represent a particularly high-risk group. Furthermore, while the systemic consequences of RVO — such as an increased risk of stroke and myocardial infarction — have been acknowledged, data focusing on visual outcomes within the diabetic cohort remain limited, especially in hospital-based clinical contexts.

Given these considerations, this hospital-based observational study proposes to utilize both clinical and demographic evaluations, systemic risk factors, and visual prognosis to resoundingly characterize diabetic patients with retinal vein occlusion. By undertaking comprehensive ocular and systemic evaluations, this study will elucidate the relationship between diabetes and RVO. Thus, the study aspires to contribute to improved visual health and quality of life for this vulnerable patient population.

Methodology

Study Design and Setting: This observational study based in a hospital was performed in Department of Regional institute of Ophthalmology, IGIMS, Patna, Bihar, India for one year. to evaluate systemic risk factors and visual outcomes in retinal vein occlusion (RVO) in patients with diabetes.

Study Population: The study population consisted of patients aged 40 years and above with a confirmed diagnosis of Type 1 or Type 2 diabetes mellitus and clinically diagnosed RVO.

Sample Size and Sampling Technique: A purposive sampling strategy was employed to recruit participants who met the inclusion criteria during the study period. Based on previous literature indicating the prevalence of RVO in diabetic populations ranging between 2% and 6%, a minimum sample size of 100 patients was determined to ensure adequate statistical power for detecting significant associations between risk factors and visual outcomes.

Data Collection Procedure: Each participant underwent a standardized clinical evaluation comprising systemic history, ocular examination, and relevant laboratory investigations:

Demographic and Clinical Variables:

- Age, sex, duration, and type of diabetes mellitus
- History of systemic hypertension, dyslipidemia, cardiovascular disease, smoking status, and alcohol consumption
- Medication history including antidiabetic, antihypertensive, lipid-lowering, and antiplatelet therapies

Ocular Assessment:

- Measurement of best-corrected visual acuity (BCVA) using Snellen's chart and converted to Log MAR for analysis
- Intraocular pressure (IOP) measurement using Goldmann applanation tonometry
- Slit-lamp biomicroscopy for anterior segment evaluation
- Fundus examination using indirect ophthalmoscopy and slit-lamp biomicroscopy with a 90D lens
- Fundus photography, OCT imaging for assessment of macular status, and FFA to differentiate ischemic from non-ischemic RVO

Systemic Investigations:

- Fasting blood glucose, glycated hemoglobin (HbA1c)
- Serum lipid profile (total cholesterol, LDL, HDL, triglycerides)
- Blood pressure measurement (systolic and diastolic)
- Serum creatinine and estimated glomerular filtration rate (eGFR)
- Body mass index (BMI)

Classification of Retinal Vein Occlusion

RVO was categorized anatomically into:

- Central Retinal Vein Occlusion (CRVO)
- Branch Retinal Vein Occlusion (BRVO)
- Hemicentral Retinal Vein Occlusion (HRVO)

Each subtype was further classified as ischemic or non-ischemic based on fundus appearance and angiographic findings. Macular edema, neovascularization, and retinal ischemia were recorded as secondary features influencing visual prognosis.

Outcome Measures

The primary outcomes of interest were:

- Identification of systemic and ocular risk factors associated with RVO in diabetic patients.
- Visual prognosis measured by change in BCVA at baseline and follow-up (where available).

Secondary outcomes included:

- Prevalence of macular edema and neovascular complications

- Requirement for therapeutic interventions such as intravitreal anti-VEGF or corticosteroid injections

Statistical Analysis: Data were coded and entered into Microsoft Excel and analyzed using IBM SPSS Statistics (version 26.0). Descriptive statistics were applied to summarize baseline characteristics. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Comparisons between groups (e.g., BRVO vs. CRVO; ischemic vs. non-ischemic) were made using the independent samples t-test or one-way ANOVA for continuous variables and Chi-square or Fisher's exact test for categorical variables. Multivariate logistic regression was employed to identify independent predictors of RVO and poor visual outcomes after adjusting for potential confounders. A two-tailed p-value of <0.05 was considered statistically significant.

Results

The present study included a total of 100 diabetic patients with clinically confirmed retinal vein occlusion. The results are organized to present the demographic and clinical characteristics of the study population, the prevalence of systemic and ocular risk factors, treatment interventions, and visual outcomes at a 3-month follow-up. Data have been summarized in tabular format to provide a comprehensive understanding of the key findings and to identify predictors associated with poor visual prognosis.

Table 1 shows the demographic profile of the participants, the mean age of the study population was 61.4 ± 8.9 years, with the majority of patients falling within the 60–69 years age group (38%), followed by 30% in the 50–59 years bracket. Male predominance was observed, accounting for 58% of the participants. The average duration of diabetes was 9.2 ± 4.7 years, indicating a long-standing glycemic burden in the majority of cases. In terms of RVO subtype, branch retinal vein occlusion (BRVO) was the most prevalent, observed in 62% of patients, followed by central RVO (28%) and hemicentral RVO (10%). Regarding laterality, 91% of cases were unilateral, while 9% exhibited bilateral involvement. These findings reflect the demographic and clinical profile of diabetic patients most at risk for developing RVO, with a predominance of older males and BRVO as the leading subtype.

Table 1: Demographic and Clinical Characteristics of the Study Population (n = 100)

Variable	n (%) / Mean ± SD
Age (years)	61.4 ± 8.9
Age group	
40–49 years	12 (12.0%)
50–59 years	30 (30.0%)
60–69 years	38 (38.0%)
≥70 years	20 (20.0%)
Gender	
Male	58 (58.0%)
Female	42 (42.0%)
Duration of diabetes (years)	9.2 ± 4.7
Type of RVO	
Branch RVO (BRVO)	62 (62.0%)
Central RVO (CRVO)	28 (28.0%)
Hemicentral RVO (HRVO)	10 (10.0%)
Laterality	
Unilateral	91 (91.0%)
Bilateral	9 (9.0%)

In Table 2, a substantial proportion of diabetic patients with retinal vein occlusion (RVO) exhibited systemic comorbidities known to exacerbate retinal vascular pathology. Hypertension was the most prevalent risk factor, present in 77% of the cohort, followed by poor glycemic control (HbA1c > 7.0%) in 81%, and hyperlipidemia in 53% of patients. Additionally, 29% had a history of smoking, and 24% were classified as obese (BMI ≥ 30 kg/m²), further contributing to a prothrombotic and inflammatory milieu. Chronic kidney disease and cardiovascular disease were identified in 15% and 20% of patients, respectively. These findings underscore the multifactorial systemic burden in diabetic individuals with RVO and highlight the importance of comprehensive cardiovascular and metabolic risk factor management in this population.

Table 2: Systemic Risk Factors among Diabetic Patients with RVO (n = 100)	
Risk Factor	**n (%)**
Hypertension	77 (77.0%)
Hyperlipidemia	53 (53.0%)
Chronic kidney disease	15 (15.0%)
Smoking history (past/current)	29 (29.0%)
Obesity (BMI ≥ 30 kg/m²)	24 (24.0%)
HbA1c > 7.0%	81 (81.0%)
Cardiovascular disease	20 (20.0%)

Table 3 Shows the baseline best-corrected visual acuity (BCVA) among the study participants was 0.72 ± 0.34 Log MAR, indicating moderate visual impairment at presentation. Macular edema was observed in 68% of the cases, making it the most common sight-threatening complication. In terms of RVO classification, 34% of the cases were ischemic and 66% were non-ischemic, reflecting a higher prevalence of the less severe subtype. Additionally, intraretinal hemorrhages were noted in 78% of patients, followed by optic disc swelling in 22%, and elevated intraocular pressure (>21 mmHg) in 12% of the cases. These findings highlight the predominance of retinal structural changes and macular involvement at presentation, with ischemia and hemorrhage being key contributors to the visual morbidity in diabetic patients with RVO.

Table 3: Ocular Characteristics and Findings (n = 100)	
Ocular Parameter	**n (%) / Mean ± SD**
Baseline BCVA (Log MAR)	0.72 ± 0.34
Macular edema present	68 (68.0%)
Ischemic RVO	34 (34.0%)
Non-ischemic RVO	66 (66.0%)
Elevated intraocular pressure (>21 mmHg)	12 (12.0%)
Optic disc swelling	22 (22.0%)
Intraretinal hemorrhage	78 (78.0%)

As presented in Table 4, the mean final best-corrected visual acuity (BCVA) at 3-month follow-up among diabetic patients with retinal vein occlusion (RVO) was 0.58 ± 0.31 Log MAR, indicating moderate visual impairment. A significant proportion of patients (71%) demonstrated improvement in visual acuity following treatment, while 19% showed no significant change, and 10% experienced deterioration in vision. Among the total sample, 66% received intravitreal therapy, of which the majority (61%) were administered anti-VEGF injections, and a smaller subset (5%) received intravitreal corticosteroids. These findings suggest that timely intravitreal intervention, particularly anti-VEGF therapy, contributed to favorable visual outcomes in the majority of patients within the short-term follow-up period.

Table 4: Visual Outcome at 3-Month Follow-up (n = 100)	
Outcome Parameter	**n (%) / Mean ± SD**
Final BCVA (Log MAR)	0.58 ± 0.31
Improvement in visual acuity	71 (71.0%)
No significant change	19 (19.0%)
Worsened visual acuity	10 (10.0%)
Received intravitreal therapy	66 (66.0%)
Anti-VEGF injections	61 (61.0%)
Intravitreal steroids	5 (5.0%)

In Table 5, multivariate logistic regression analysis identified ischemic retinal vein occlusion (RVO) (adjusted OR = 3.21, 95% CI: 1.45–7.10, p = 0.004), macular edema (adjusted OR = 2.47, 95% CI: 1.09–5.61, p = 0.03), and poor glycemic control (HbA1c > 8%) (adjusted OR = 2.85, 95% CI: 1.22–6.63, p = 0.015) as statistically significant independent predictors of poor visual prognosis (Log MAR ≥ 0.7 at 3 months) in diabetic patients with RVO. These findings underscore the critical role of retinal ischemia, macular involvement, and uncontrolled diabetes in determining adverse visual outcomes. Although longer duration of diabetes (>10 years) (adjusted OR = 1.98, p = 0.082) and age ≥ 65 years (adjusted OR = 1.66, p = 0.212) were associated with increased odds of poor visual outcomes, they did not

reach statistical significance. Overall, the results highlight the necessity of prompt management of macular complications and systemic glycemic control to mitigate vision loss in this population.

Table 5: Multivariate Logistic Regression – Predictors of Poor Visual Prognosis (Log MAR ≥ 0.7 at 3 months)

Variable	Adjusted OR	95% CI	p-value
Ischemic RVO	3.21	1.45 – 7.10	0.004
Macular edema	2.47	1.09 – 5.61	0.03
HbA1c > 8%	2.85	1.22 – 6.63	0.015
Duration of diabetes >10 years	1.98	0.91 – 4.31	0.082
Age ≥ 65 years	1.66	0.75 – 3.66	0.212

Discussion

The present hospital-based observational study provides a comprehensive analysis of the clinical profile, systemic associations, ocular findings, treatment outcomes, and predictors of visual prognosis in diabetic patients with retinal vein occlusion (RVO). The findings align with existing literature and offer additional insight into the interplay between systemic comorbidities and visual outcomes in this high-risk population.

The demographic data showed an overall male predominance (58%) and a mean age of 61.4 years, with the majority of cases (63%) in the 60–69-year age cohort. These findings are congruous with previously described demographics of RVO, as it generally occurs in older adults due to cumulative microvascular injury associated with age and longstanding diabetes (Zhou et al., 2013)(Thapa et al., 2017). Furthermore, branch retinal vein occlusion (BRVO) was the most frequently observed subtype (62%), and this is reflective of global epidemiological data describing BRVO as more common than central or hemicentral. Notably, most cases were unilateral, which aligns with other cohort studies that report similar laterality.

The systemic risk profile demonstrated substantial burden of comorbidities among patients, including hypertension (77%), hyperlipidemia (53%), and poor glycemic control (HbA1c >7% in 81%). These findings support the established correlation of vascular risk factors in RVO pathogenesis and show the necessity of structured management of systemic risk factors. Comparable studies, such as the Bhaktapur Retina Study and Denmark's case-control study by Bertelsen et al., similarly identified hypertension and diabetes as prominent risk factors for RVO (Bertelsen et al., 2012).

The ocular characteristics at presentation demonstrated a mean baseline BCVA of 0.72 Log MAR, with 68% of patients having been diagnosed with macular edema, and 78% presenting with intraretinal hemorrhages. Of the patients, one third were classified as ischemic (known to have a worse prognostic outcome). Although less common, presence of optic disc swelling and raised intraocular pressure indicated more severe disease. Clinical characteristics suggest retinal structural compromise inherent to the disease processes at the inception of RVO and the presence of macular involvement is a visual threat, as has been documented previously in population-based studies like the Beijing Eye Study [8]. We were pleased to note that the visual outcomes after treatment were positive in the majority of cases. At three months, 71% of patients improved in their visual acuity (mean BCVA improved to 0.58 Log MAR). 66% of patients overall received intravitreal therapy (anti-VEGF injections predominantly) which have been shown to be most effective in RVO related macular edema. Outcomes in our results reflect clinical observations from real-world practice and from broader studies demonstrating the utility of anti-VEGF agents in improving or stabilizing RVO patient vision.

Significantly, multivariate analysis revealed that ischemic RVO (OR = 3.21), macular edema (OR = 2.47), and poor glycemic control (HbA1c >8%; OR = 2.85) are statistically significant predictors of poor visual prognosis (Log MAR ≥ 0.7). This is reassuring as it is consistent with previous research that proposes retinal perfusion status and metabolic control underlie visual outcomes, especially ischemic Retinal Venous Occlusions and chronic hyperglycemia leading to exacerbated retinal damage and less favorable treatment response (Chen et al., 2017) (Hasan et al., 2023). Additionally, both advanced age and longer duration of diabetes were correlated to vision worse than 20/100 but did not reach statistical significance, which implies that acute parameters related to disease may be a more important consideration than chronic systemic duration alone. Ultimately, this study emphasizes the importance of complexity and multifactorial circumstances surrounding RVO in diabetic individuals. Furthermore, it emphasizes timely ophthalmology intervention, close observation of macular edema, and vigorous systemic medial treatment of diabetes and vascular comorbidities to optimize the chances of achieving better vision. Future directions for the research can include understanding patient prognosis at longer than the three-month time point, and evaluating the comparative effectiveness of distinct treatment regimens in unique diabetic groups.

Conclusion

This study demonstrates the multifactorial etiology of retinal vein occlusion (RVO) in a cohort of diabetic persons, where systemic comorbidities such as hypertension, hyperlipidemia, and suboptimal glycemic control were key contributors to the disease process and progression. Branch RVO was the most frequently detected subtype, and macular edema was the most prevalent ocular complication contributing to visual morbidity. While the majority of patients experienced visual improvement following intravitreal anti-VEGF injections, there were significant independent predictors of poor visual prognosis identified in the multivariate modeling which included ischemic RVO, macular edema, and HbA1c. Together, these data support the need for early ophthalmologic intervention, while also managing systemic risk factors to optimize visual function among diabetic patients with RVO.

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