Section: Ophthalmology

Original Research Article

# A STUDY TO COMPARE THE SERUM LIPID PROFILE, RENAL PROFILE, AND HBA1C IN PATIENTS WITH RETINAL VEIN OCCLUSION AND IN PATIENTS WITHOUT RETINAL VEIN OCCLUSION AT KMCRI HUBLI HOSPITAL – A COMPARATIVE STUDY

*Anushree J T[1], Nallamothu Dileep Kumar[1], Vivekanand Jivangi[2]*

[1]*Postgraduate, Department of Ophthalmology, Karnataka Medical college and research institute, Hubli, Karnataka, India.*
[2]*Professor, Department of Ophthalmology, Karnataka Medical college and research institute, Hubli, Karnataka, India.*

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**Corresponding Author:**
**Dr. Anushree J T**
Postgraduate, Department of ophthalmology, Karnataka Medical college and research institute, Hubli, Karnataka, India.
Email: anushreetimmapa@gmail.com

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ABSTRACT

**Background:** Retinal vein occlusion (RVO) is the second most common sight-threatening retinal vascular disorder after diabetic retinopathy. It results from obstruction of the central or branch retinal vein and is strongly linked to systemic vascular disease. To compare serum lipid profile, renal profile, and HbA1C between patients with and without RVO, and to examine associations with hypertension and diabetes mellitus.

**Materials and Methods:** A two-year comparative study was conducted at a tertiary hospital in North Karnataka, including 72 subjects (36 RVO cases, 36 age-matched controls). Individuals on drugs affecting lipid metabolism were excluded. Fasting and post-prandial blood sugar, HbA1c, serum lipid and renal profiles, and homocysteine levels were analyzed.

**Results:** RVO patients showed significantly higher LDL, triglycerides, blood urea, creatinine, and homocysteine, with lower HDL ($p \leq 0.001$ for all). Post-prandial blood sugar was also elevated ($p<0.001$). Diabetes and hypertension were present in 75% of RVO patients versus 0% of controls ($p<0.001$). Branch RVO was the most common subtype (52.8%).

**Conclusion:** RVO is closely associated with systemic vascular risk factors, including dyslipidaemia, hyperglycemia, renal dysfunction, and hyperhomocysteinemia. These findings underscore the need for comprehensive systemic evaluation in RVO patients.

**Keywords:** Retinal vein occlusion; dyslipidaemia; hypertension; diabetes; HbA1c; creatinine; homocysteine; BRVO.

## INTRODUCTION

Retinal vein occlusion (RVO) is the second most common retinal vascular disorder causing visual impairment after diabetic retinopathy.[1] It results from obstruction of the retinal venous system, affecting either the central retinal vein or a branch retinal vein[2]. Clinically, RVO is classified as Branch Retinal Vein Occlusion (BRVO) or Central Retinal Vein Occlusion (CRVO), with BRVO being more frequent.[3]

Typical clinical findings include retinal hemorrhages, venous dilatation and tortuosity, cotton-wool spots, and macular edema.[4] Globally, RVO affects approximately 16.4 million adults, with prevalence increasing with age.[5] CRVO is usually linked to thrombosis behind the lamina cribrosa, while BRVO most commonly occurs at arteriovenous crossings, where an artery compresses the underlying vein.[6]

Systemic hypertension, diabetes mellitus, and cardiovascular disease are recognized as major risk factors for RVO.[7,8] Despite extensive research, the systemic metabolic and renal associations contributing to RVO remain incompletely characterized, complicating prevention and management.

This study was therefore undertaken to evaluate and compare the serum lipid profile, renal parameters,

and glycated hemoglobin (HbA1c) levels in patients with and without RVO, in order to better understand the systemic metabolic factors contributing to disease occurrence.

## MATERIALS AND METHODS

This comparative study was conducted over two years, from April 2023 to March 2025, in the Department of Ophthalmology at the Karnataka Institute of Medical Sciences (KIMS, now KMCRI), Hubballi, a tertiary care hospital in North Karnataka. The study compared serum lipid profile, renal profile, and HbA1c levels between patients with Retinal Vein Occlusion (RVO) and age-matched controls.

A total of 72 participants were included—36 newly diagnosed RVO patients and 36 controls without RVO. The sample size was estimated based on detecting a mean serum cholesterol difference of 50 mg/dl between groups, with 1% alpha error and 90% power. After accounting for 20% attrition, the final sample size was 36 per group.

Patients aged 40 years or older, of either gender, with a recent RVO diagnosis were included. Exclusion criteria were vasculitis, ocular diseases causing visual loss, immunocompromised states, pregnancy, and medications affecting lipid metabolism such as antilipidemic drugs, oral contraceptives, glucocorticoids, or thiazide diuretics.

All participants provided informed consent and underwent detailed history taking and comprehensive ophthalmic evaluation. Blood tests included Fasting and Post-Prandial Blood Sugar, HbA1c, lipid profile (Total Cholesterol, Triglycerides, HDL, LDL), renal profile (Blood Urea, Serum Creatinine), and Homocysteine. Lipid reference values followed NCEP ATP III guidelines.

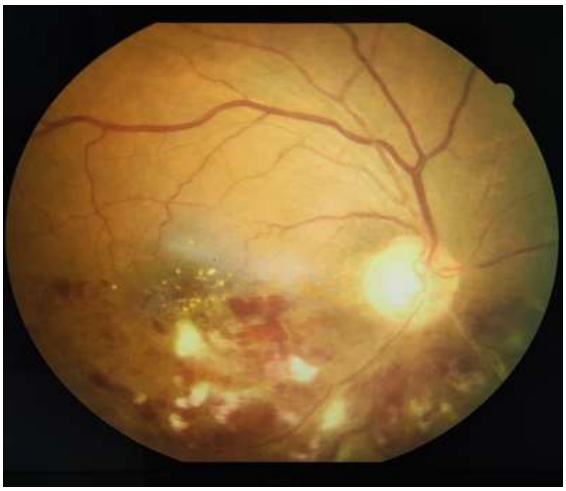

**Figure 1: shows Inferior Hemi-retinal vein occlusion**

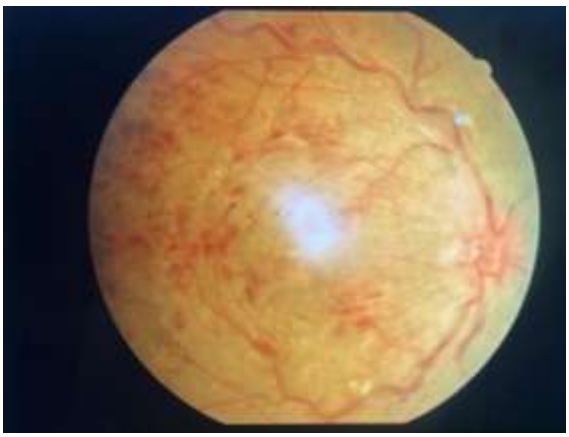

**Figure 2: show Central retinal vein occlusion**

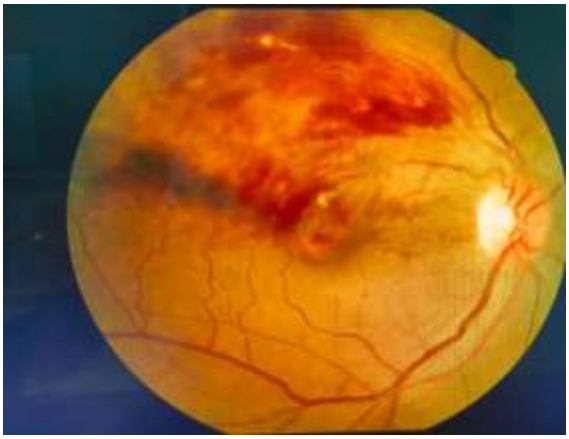

**Figure 3: Shows Supero temporal Branched retinal vein occlusion**

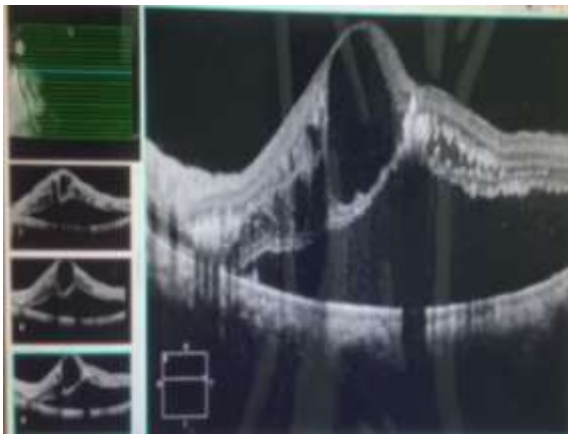

**Figure 4: Shows retinal vein occlusion associated macular edema in OCT**

## RESULTS

This comparative study included 72 participants, comprising 36 patients with Retinal Vein Occlusion (RVO) and 36 age- and gender-matched controls. The mean age was identical between groups (58.0 ± 8.16 years; p = 1.000), and both groups had the same gender distribution (52.8% male, 47.2% female; p = 1.000), confirming successful matching.

**Table 1: Association of Diabetes and Hypertension in Study Population**

| Past Medical History | Cases (n=36) | Controls (n=36) | p-value |
|---|---|---|---|
| Diabetes Mellitus (DM) | 3 (8.3%) | 0 (0.0%) | <0.001* |
| Hypertension (HTN) | 14 (38.9%) | 0 (0.0%) | |
| DM + HTN | 10 (27.8%) | 0 (0.0%) | |
| None | 9 (25.0%) | 36 (100.0%) | |

***Statistically significant***

RVO patients showed a significant association with systemic vascular comorbidities. Overall, 75% of cases had either diabetes mellitus (DM) and/or hypertension (HTN), whereas all controls were systemically healthy ($p < 0.001$). Hypertension alone was the most common risk factor (38.9%), followed by combined DM + HTN (27.8%).

Among RVO patients, Branch Retinal Vein Occlusion (BRVO) was most common (52.8%), followed by Central RVO (CRVO) (38.9%) and Hemi-Retinal Vein Occlusion (HRVO) (8.3%).

**Table 2: Distribution of Retinal Vein Occlusion Subtypes**

| Type of RVO | Number | Percentage |
|---|---|---|
| BRVO | 19 | 52.8% |
| CRVO | 14 | 38.9% |
| HRVO | 3 | 8.3% |
| Total | 36 | 100.0% |

RVO patients demonstrated a characteristic dyslipidaemic profile with significantly higher LDL and triglyceride levels, and lower HDL levels compared to controls. Total cholesterol did not differ significantly. According to NCEP ATP III criteria, 69.4% of RVO cases had elevated triglycerides (>150 mg/dl) and 38.9% had low HDL (<40 mg/dl), compared with none among controls ($p < 0.001$).

Additionally, RVO patients showed higher post-prandial glucose and HbA1c values, indicating impaired glycemic control. Abnormal PPBS (≥140 mg/dl) was present in 69.4% of RVO cases versus 11.1% of controls ($p < 0.001$). HbA1c values in the diabetic range (≥6.5%) were found in 31.4% of cases and only 2.8% of controls ($p = 0.005$).

**Table 3: Comparison of Lipid and Glycemic Parameters Between Cases and Controls**

| Parameter (Mean ± SD) | Cases (n=36) | Controls (n=36) | p-value |
|---|---|---|---|
| Total Cholesterol (mg/dl) | 176.08 ± 39.80 | 167.64 ± 18.81 | 0.254 |
| LDL (mg/dl) | 92.09 ± 22.23 | 74.81 ± 20.40 | 0.001* |
| HDL (mg/dl) | 43.23 ± 7.61 | 50.06 ± 5.84 | <0.001* |
| Triglycerides (mg/dl) | 190.97 ± 87.46 | 128.69 ± 11.98 | <0.001* |
| PPBS (mg/dl) | 165.50 ± 45.13 | 128.72 ± 11.01 | <0.001* |
| HbA1c (%) | 6.12 ± 1.10 | 5.53 ± 0.42 | 0.005* |

***Statistically significant***

RVO patients exhibited significant renal impairment and elevated homocysteine levels compared to controls. Mean blood urea and serum creatinine were markedly higher among RVO cases. Nearly half of the RVO patients (44.4%) had raised urea (>20 mg/dl), and 47.2% had elevated creatinine (>1.1 mg/dl), compared with 0% and 13.9% among controls.

Homocysteine levels were also substantially elevated in RVO cases (18.31 ± 6.82 µmol/L) versus controls (11.83 ± 3.36 µmol/L, $p < 0.001$). Elevated homocysteine (>15 µmol/L) was found in 52.8% of RVO patients and 11.1% of controls, confirming its strong association with RVO.

**Table 4: Comparison of Renal and Homocysteine Parameters Between Cases and Controls**

| Parameter (Mean ± SD) | Cases (n=36) | Controls (n=36) | p-value |
|---|---|---|---|
| Blood Urea (mg/dl) | 21.55 ± 6.60 | 12.03 ± 3.90 | <0.001* |
| Serum Creatinine (mg/dl) | 1.15 ± 0.31 | 0.96 ± 0.27 | 0.006* |
| Homocysteine (µmol/L) | 18.31 ± 6.82 | 11.83 ± 3.36 | <0.001* |

***Statistically significant***

## DISCUSSION

This comparative study evaluated systemic metabolic, renal, and glycemic parameters in patients with retinal vein occlusion (RVO) compared to age- and gender-matched controls. Both groups were well matched for age (mean 58.0 ± 8.16 years) and gender distribution, eliminating demographic confounders. This strengthens the internal validity of the findings, confirming that observed differences arise from disease-related rather than demographic factors.

The mean age in this study aligns with epidemiological evidence showing that RVO predominantly affects middle-aged and elderly individuals.[5] Rogers et al. reported a sharp increase in RVO prevalence from 0.7 per 1,000 below 40 years to 4.6 per 1,000 above 60 years.[5] Similarly, the Blue Mountains Eye Study demonstrated an exponential rise with advancing age.[3] Although our

mean age was slightly lower than that reported in the Central Vein Occlusion Study (65 years) and Branch Vein Occlusion Study (63 years) [9], this may reflect regional differences or earlier onset due to lifestyle and metabolic factors in the Indian population.

A major finding was the strong association between systemic vascular risk factors and RVO. In our cohort, 75% of patients had either hypertension or diabetes mellitus, while none of the controls did ($p < 0.001$). Hypertension alone was present in 38.9%, diabetes alone in 8.3%, and both in 27.8%. These findings concur with large-scale reports such as the Eye Disease Case-Control Study, which reported an odds ratio (OR) of 3.5 for BRVO in hypertensive patients.[10] Similarly, O'Mahoney et al. in a meta-analysis of 21 studies, found hypertension significantly associated with both CRVO (OR 3.8) and BRVO (OR 3.0).[7]

The prevalence of diabetes in our study (36.1%) parallels the results of Zhou et al., who found diabetes independently increased RVO risk (OR 1.74, 95% CI 1.43–2.11).[11] Lim et al. also identified diabetes as an independent predictor (adjusted OR 1.85).[8] Coexistence of hypertension and diabetes confers a synergistic risk, as shown in the Singapore Indian Eye Study (OR 3.61; 95% CI 1.77–7.36).[8] This dual metabolic burden likely accelerates endothelial dysfunction, platelet activation, and vascular inflammation, precipitating venous occlusion.

In our study, BRVO (52.8%) was the most frequent subtype, followed by CRVO (38.9%) and HRVO (8.3%), reflecting global trends. The Blue Mountains Eye Study and Eye Disease Case-Control Study reported BRVO to be approximately three times more prevalent than CRVO.[3,10] Rogers et al. found pooled prevalence rates of 4.42 per 1,000 for BRVO and 0.80 per 1,000 for CRVO.[5] The slightly lower BRVO:CRVO ratio (1.4:1) in our study may reflect referral bias or sample size differences.

A distinct pattern of dyslipidemia was evident in RVO patients, with elevated LDL and triglycerides and reduced HDL compared to controls. As per NCEP ATP III criteria, 69.4% had hypertriglyceridemia, 38.9% had low HDL, and 22.2% had hypercholesterolemia. Similar associations were observed by Wong et al., who found a 2.5-fold increase in RVO risk with dyslipidemia,[12] and by the Blue Mountains Eye Study, linking elevated LDL and total cholesterol to RVO.[3]

Hypertriglyceridemia emerged as a major metabolic abnormality. Weger et al. reported that each 10 mg/dl rise in triglycerides increased RVO risk by 8%, due to enhanced viscosity and thrombogenicity.[13] Low HDL (mean 43.23 mg/dl in cases vs. 50.06 mg/dl in controls, $p < 0.001$) indicates reduced vascular protection, consistent with the Eye Disease Case-Control Study, which estimated that each 5 mg/dl decrease in HDL increases RVO risk by 15%.[10]

Although LDL was higher in cases (mean 92.09 mg/dl vs. 74.81 mg/dl), only 2.8% exceeded 130 mg/dl, suggesting that even modest LDL elevations may be pathogenic. Sofi et al. made similar observations, noting increased RVO risk even at subclinical LDL elevations.[14] Total cholesterol was not significantly different, supporting Yau et al., who concluded that isolated total cholesterol lacks predictive value.[5]

Our study also confirmed the association between RVO and impaired glucose regulation. While fasting glucose differences were nonsignificant, postprandial blood sugar (PPBS) and HbA1c were markedly higher in RVO cases. Abnormal PPBS ≥140 mg/dl occurred in 69.4% versus 11.1% of controls ($p < 0.001$). Cavalot et al. demonstrated that postprandial glucose better predicts vascular complications than fasting glucose.[15] Elevated HbA1c ≥6.5% in 31.4% of RVO cases (vs. 2.8% controls) supports chronic hyperglycemia as a driver of endothelial injury and oxidative stress.

Renal parameters were significantly higher in RVO cases — blood urea (21.55 vs. 12.03 mg/dl; $p < 0.001$) and serum creatinine (1.15 vs. 0.96 mg/dl; $p = 0.006$) — suggesting systemic endothelial dysfunction. Mahoney et al. reported similar trends (BUN 22.4 vs. 14.1 mg/dl).[16] Ponto et al. and Zhang et al. demonstrated a dose-dependent increase in RVO risk with renal impairment.[9,17]

Hyperhomocysteinemia was observed in 52.8% of RVO cases, with mean levels significantly higher than controls (18.31 vs. 11.83 µmol/L; $p < 0.001$). Elevated homocysteine promotes thrombosis, platelet activation, and endothelial damage. Glueck et al. detected elevated levels in 40% of RVO cases and advocated B-vitamin supplementation.[18] Marcucci et al. and Cugati et al. also identified homocysteine as a modifiable biomarker in RVO.[19,20]

Finally, intraocular pressure (IOP) did not differ significantly between groups, consistent with the Beaver Dam Eye Study, which reported no link between baseline IOP and RVO incidence over 15 years.[21] This underscores that systemic vascular factors, rather than ocular hypertension alone, play a dominant role in RVO pathogenesis.

## CONCLUSION

This study demonstrates that retinal vein occlusion (RVO) is closely linked to systemic vascular abnormalities. Seventy-five percent of RVO patients had hypertension, diabetes, or both, highlighting their strong association. Significant dyslipidaemia, impaired glucose metabolism, renal dysfunction, and elevated homocysteine levels were observed in RVO patients compared to controls. Branch RVO was the most common subtype. These findings confirm that RVO reflects underlying systemic vascular disease rather than an isolated ocular event. Comprehensive screening and management of metabolic, renal, and vascular risk factors are essential to prevent recurrence and improve both visual and systemic outcomes.

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