

Association of Serum Vitamin D Levels with Retinal Vein Occlusion in Patients Younger Than 50 Years: A Case–Control Study

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Abstract

Purpose: To evaluate serum 25-hydroxyvitamin D levels in patients younger than 50 years with retinal vein occlusion (RVO) and compare them with age- and sex-matched controls.

Methods: This hospital-based observational study included 60 participants aged <50 years: 30 patients with RVO and 30 controls without retinal vascular disease. All underwent comprehensive ophthalmic evaluation and serum 25-hydroxyvitamin D estimation. Vitamin D levels were categorized as deficient (<20 ng/mL), insufficient (20–30 ng/mL), or sufficient (>30 ng/mL).

Results: Mean serum vitamin D levels were significantly lower in RVO patients compared with controls (19.7 ± 8.0 vs 29.6 ± 12.5 ng/mL; $p < 0.001$). Vitamin D deficiency was observed in 60% of cases and 20% of controls ($p = 0.0035$). No significant difference in vitamin D levels was noted between branch and central RVO.

Conclusion: Vitamin D deficiency is significantly associated with RVO in patients younger than 50 years and may represent a modifiable systemic risk factor.

Keywords: Retinal vein occlusion; Vitamin D deficiency; Branch retinal vein occlusion; Central retinal vein occlusion.

I. INTRODUCTION

Retinal vein occlusion (RVO) is the second most common retinal vascular disorder after diabetic retinopathy and an important cause of visual impairment. It is broadly classified into central retinal vein occlusion (CRVO) and branch retinal vein occlusion (BRVO), with BRVO being more prevalent. [1–3] Systemic conditions such as hypertension, diabetes mellitus, dyslipidaemia, and glaucoma are well-established risk factors. [3,4] However, RVO occurring in younger individuals suggests the contribution of additional systemic and metabolic factors.[2]

The pathogenesis of RVO reflects Virchow's triad—venous stasis, endothelial dysfunction, and hypercoagulability.[3] Vitamin D has demonstrated anti-inflammatory, endothelial- protective, and antithrombotic properties, and deficiency has been associated with cardiovascular and thromboembolic disorders.[5,6] Emerging evidence suggests a possible association between vitamin D deficiency and retinal vascular occlusive disease.[5–8] This study evaluates serum vitamin D levels in RVO patients below 50 years of age and explores its association with clinical characteristics. Retinal vein occlusion (RVO) is the second most common retinal vascular disorder after diabetic retinopathy and an important cause of visual impairment. It is broadly classified into central retinal vein occlusion (CRVO) and branch retinal vein occlusion (BRVO), with BRVO being more prevalent. Systemic conditions such as hypertension, diabetes mellitus, dyslipidaemia, and glaucoma are well-established risk factors; however, RVO occurring in younger individuals suggests the contribution of additional systemic and metabolic factors.

The pathogenesis of RVO reflects Virchow's triad—venous stasis, endothelial dysfunction, and hypercoagulability. Vitamin D has demonstrated anti-inflammatory, endothelial- protective, and antithrombotic properties, and deficiency has been associated with cardiovascular and thromboembolic disorders. Data on the association between vitamin D status and RVO, particularly in younger patients, remain limited. This study evaluates serum vitamin D levels in RVO patients below 50 years of age and explores its association with clinical characteristics.

II. METHODS

This hospital-based observational study was conducted at a tertiary care center over 18 months after institutional ethics committee approval. Sixty participants aged <50 years were enrolled: 30 consecutive patients diagnosed with RVO (cases) and 30 age- and sex- matched controls with refractive errors or minor ocular complaints and retinal pathologies except retinal vein occlusion.

Patients receiving vitamin D supplementation, those with renal or hepatic disease, chronic alcoholism, or unwilling to consent were excluded. All participants underwent best- corrected visual acuity assessment, slit-lamp biomicroscopy, intraocular pressure measurement, dilated fundus examination, and optical coherence tomography. Serum 25- hydroxyvitamin D levels were measured using chemiluminescence assay and categorized as deficient (<20 ng/mL), insufficient (20–30 ng/mL), or sufficient (>30 ng/mL).[5]

Statistical analysis was performed using SPSS version 30 software. Continuous variables were expressed as mean \pm standard deviation. A p-value <0.05 was considered statistically significant.

III. RESULTS

Table 1. Distribution of Serum Vitamin D Levels in Cases and Controls

Serum Vitamin D level (ng/mL)	RVO cases (n=30)	Controls (n=30)
<20 (Deficient)	18 (60%)	6 (20%)
20–30 (Insufficient)	9 (30%)	13 (43.3%)
>30 (Sufficient)	3 (10%)	11 (36.7%)

Table 2. Baseline Characteristics and Systemic Risk Factors

Variable	RVO cases (n=30)	Controls (n=30)
Age (years), mean \pm SD	43.7 \pm 6.0	40.8 \pm 6.1
Male : Female	18 : 12	18 : 12
Hypertension	14 (46.7%)	5 (16.7%)
Diabetes mellitus	12 (40.0%)	4 (13.3%)
Smoking	10 (33.3%)	2 (6.7%)

Table 3: Correlation of Vitamin D levels with type of RVO in cases

Vitamin-D level	BRVO	CRVO	p value
<20	14	04	0.144
20-30	04	05	
>30	01	02	

The mean age and gender distribution were comparable between groups. The mean age of RVO patients was 43.7 \pm 6.0 years and controls 40.8 \pm 6.1 years, with no significant difference. Gender distribution was identical in both groups.

Vitamin D deficiency (<20 ng/mL) was significantly more common among RVO patients (60%) compared to controls (20%). Mean serum vitamin D levels significantly lower in cases than controls (p<0.001).

Hypertension, diabetes mellitus, and smoking were significantly more prevalent in RVO patients. Serum vitamin D levels did not differ significantly between BRVO and CRVO.

IV. DISCUSSION

The present study demonstrates a significant association between vitamin D deficiency and RVO in patients younger than 50 years. This finding is consistent with earlier Indian and international studies reporting lower serum vitamin D levels in RVO patients.[5–8]

The biological plausibility of this association lies in vitamin D's role in maintaining endothelial integrity, reducing inflammation, and modulating thrombosis.[6,10] Deficiency may therefore contribute to a

prothrombotic milieu, increasing susceptibility to retinal venous occlusion. In addition, traditional systemic risk factors such as hypertension, diabetes mellitus, and smoking were more prevalent among RVO patients, corroborating prior epidemiological studies.[1,3,9]

The absence of a significant difference in vitamin D levels between BRVO and CRVO in this study mirrors findings from previous reports.[7,8] Vitamin D deficiency may therefore be more relevant to RVO occurrence rather than subtype or extent. The present study demonstrates a significant association between vitamin D deficiency and RVO in patients younger than 50 years. This finding supports emerging evidence that vitamin D deficiency may contribute to retinal vascular occlusive disease through endothelial dysfunction, inflammation, and prothrombotic mechanisms.

Consistent with previous studies, traditional systemic risk factors such as hypertension, diabetes mellitus, and smoking were more common in RVO patients, underscoring the systemic vascular nature of the disease. Vitamin D deficiency may act as an additional, potentially modifiable risk factor, particularly relevant in younger patients with fewer age-related comorbidities.

V. CONCLUSION

Vitamin D deficiency is significantly associated with retinal vein occlusion in patients younger than 50 years. Evaluation of vitamin D status may be considered as part of the systemic assessment of young RVO patients. Larger prospective studies are required to establish causality and to assess the role of vitamin D supplementation in RVO management.

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