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Uncovering The Intricacy Of Retinal Vein Occlusion (RVO): Perspectives From Patient Populations, Therapeutic Results, And Vascular Risk Factors

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Abstract

Background:

Retinal vein occlusion (RVO) is a significant ocular condition characterized by the obstruction of the venous outflow from the retina. Its a common vascular disorder that can cause a number of visual impairments. Depending on the location and extent of the blockage, RVO can be classified into two types: central retinal vein occlusion (CRVO) and branch retinal vein occlusion (BRVO).

Aims:

Exploring diverse patient experiences, treatment outcomes, and associated vascular risk factors.

Methods:

This research adopts a retrospective observational approach, through an examination of patient populations, treatment outcomes, and vascular risk factor. The study included patients over the age of 18 who were diagnosed with RVO, possessing complete medical records and treatment data. Descriptive statistics were used for percentages, mean and standard deviation to find patient demographics and vascular risk factors. Inferentials were calculated using Wilcoxon Signed Ranks test to compare pre and post-treatment visual acuity.

Results:

The study discovered that patients aged 50 and up with a history of hypertension were more likely to develop BRVO. The most prevalent type was BRVO, followed by CRVO. Patients with BRVO, no diabetes history, and under the age of 50 experienced the greatest improvement in visual acuity following treatment. No associations were found between age, gender, hypertension history, type of RVO, treatment, or affected eye.

Conclusion:

RVO is a serious ophthalmic condition characterized by occlusion in blood vessels from the retina. It can present with other complications like severe swelling, edema, and hemorrhage. RVO is prevalent in developed countries and it is common in developing countries. Retinal vein occlusion requires immediate therapy otherwise it may lead to loss of vision. With advances in ophthalmology, currently, there are many effective treatment options.

Keywords:

Retinal vein occlusion (RVO), patient experience, treatment outcomes, vascular disorder, ophthalmology.

Introduction:

Retinal vein occlusion (RVO) is a significant ocular condition characterized by the obstruction of the venous outflow from the retina (American Academy of Ophthalmology, 2023, Talcott et al., 2021). It is a common vascular disorder that can cause a number of visual impairments and complications including vision loss (National Eye Institute, 2022). Depending on the location and extent of the blockage, RVO can be classified into two types: central retinal vein occlusion (CRVO) and branch retinal vein occlusion (BRVO) (Wong et al., 2020). Ip and Hendrick (2019) classified a third type, hemiretinal vein occlusion (HRVO) that is often considered a separate

condition with features similar to both BRVO and CRVO.

The first clinical picture of retinal vein occlusion was described by liebreich in 1855 and was called “retinal apoplexy”(Liebreich, 1855). It was established as a clinical entity caused by thrombosis in 1878 by Michel (Michel, 1878). The information until then was more accurately summarised by Duke-Elder and Dobree (Duke-Elder, 1974)(Hayreh, 2014).

The prevalence of RVOs is about 0.5% in the 2008 general world population aged 30 years and older with an estimated 16 million affected worldwide (Flaxel et al., 2020). Several risk factors such as diabetes, hypertension, smoking, obesity, age, and glaucoma contribute to the development of RVO (American Academy of Ophthalmology, 2020, Yousef et al., 2020). The location and degree of the occlusion, as well as the development of secondary complications such as macular edema and neovascularization, determine the clinical presentation and prognosis of RVO (Talcott et al., 2021). Patients with RVO may experience reduced visual acuity, scotomas, ocular discomfort, or acute vision loss (American Academy of Ophthalmology, 2020). A thorough clinical evaluation of the patient and the use of imaging modalities such as fluorescein angiography and optical coherence tomography are essential for the diagnosis of RVO (Al-Sheikh et al., 2017, Talcott et al., 2021).

The treatment of RVO aims to restore vision or preserve visual function. It also aims to prevent or reduce the complications of the occlusion, such as macular edema, neovascularization, and glaucoma. Available treatment options include systemic injections (Yousef et al., 2020), intravitreal injections (Chatziralli et al., 2020), laser photocoagulation, or surgical interventions

(American Academy of Ophthalmology, 2020; Talcott et al., 2021). The management of RVO also involves addressing the underlying risk factors, to prevent progression and recurrence of RVO.

This paper delves into the complexities of Retinal Vein Occlusion (RVO), exploring diverse patient experiences, treatment outcomes, and associated vascular risk factors.

Methodology

Study Design:

This research adopts a retrospective observational approach to delve into the complexities of Retinal Vein Occlusion (RVO). Through an examination of patient populations, treatment outcomes, and vascular risk factors, the study aims to offer comprehensive insights into this condition.

Population Selection:

Inclusion Criteria: Patients aged 18 and above diagnosed with RVO, possessing complete medical records and treatment data.

Exclusion Criteria: Patients with incomplete medical records or those diagnosed with other ocular conditions.

Data Collection:

1. **Patient Demographics:** Gathering data on age, gender, and medical history of diabetes and hypertension.
2. **RVO Characteristics:** Documenting the type of RVO (BRVO, CRVO, HRVO), affected eye, and treatment administered.
3. **Vascular Risk Factors:** Assessing the serum lipid profile including total cholesterol, triglycerides, LDL, and HDL.

4. **Therapeutic Outcomes:** Recording visual acuity levels before and after treatment.

Data Analysis:

1. **Descriptive Statistics:** Employing percentages, means, and standard deviations to summarize patient demographics, RVO characteristics, and vascular risk factors.
2. **Inferential Statistics:** Utilizing the Wilcoxon Signed Ranks Test to compare pre and post-treatment visual acuity, alongside calculating odds ratios with 95% confidence intervals to explore associations between variables and the development of BRVO as well as improvements in visual acuity post-treatment.

Ethical Considerations:

- *Institutional Review Board (IRB) Approval:* Obtaining ethical approval from the relevant review board.
- *Confidentiality Measures:* Ensuring patient confidentiality through the anonymization of data.
- *Informed Consent:* Waiving the need for informed consent due to the retrospective nature of the study.

Limitations:

Retrospective Design: Acknowledging limitations in controlling confounding variables inherent in retrospective studies.

Results:

Variables	**RVO+ (n=91)**	**RVO- (n=85)**
Age (yrs)		
≤ 49	42.35% (36)	57.65% (49)
≥ 50	60.44% (55)	39.56% (36)
Gender		
Male	54.63% (59)	45.37% (49)
Female	47.06% (32)	52.94% (36)
Hx of Diabetes		
No DM	54.70% (64)	45.30% (53)
DM+	44.83% (26)	55.17% (32)
Hx of Hypertension		
No HTN	31.52% (29)	68.48% (63)
HTN+	73.81% (62)	26.19% (22)
Type of RVO*		
BRVO	48.35% (44)	---
CRVO	36.26% (33)	---

HRVO	9.89% (9)	---
Affected Eye		
OD	48.35% (44)	---
OS	51.65% (47)	---
Treatment applied		
Avantis	62.22% (56)	---
Eylea	3.33% (3)	---
Lucentis	34.44% (31)	---
Serum Total Cholesterol		
<199	51.94% (67)	48.06% (62)
≥200	51.06% (24)	48.94% (23)
Serum Triglycerides		
<149	56.34% (40)	43.66% (31)
≥150	48.57% (51)	51.43% (54)
Serum LDL		
<99	51.06% (24)	48.94% (23)
≥100	51.94% (67)	48.06% (62)
Serum HDL		
>39	88.24% (15)	11.76% (2)

≤40	47.80% (76)	52.20% (83)

*missing=5

Table 1: Percentages and numbers of characteristics of the participants

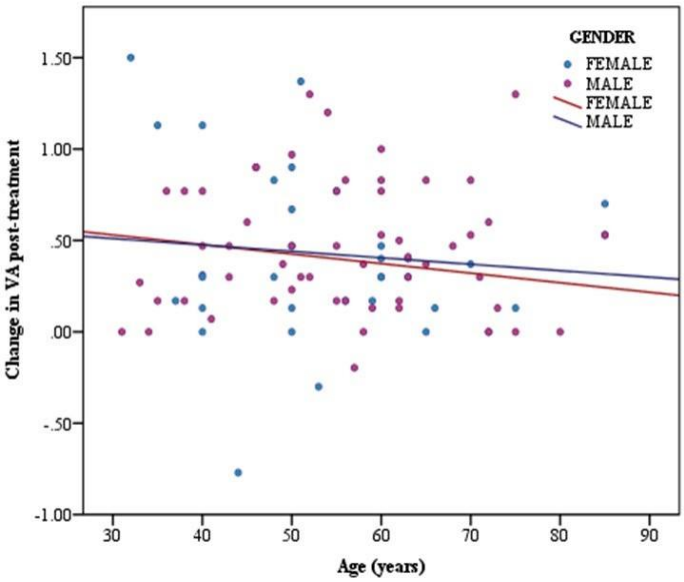

Figure 1: Change in visual acuity after treatment in relation to age.

Variables	**VA Baseline ($\bar{x}$, sd.)**	**VA post-treatment ($\bar{x}$, sd.)**	**P value**	**% Difference from VA Baseline**
All participants (n=91)	0.83 (±0.54)	0.42 (±0.53)	**<0.001**	49.40
Age (yrs)				
< 50	0.79 (±0.56)	0.34 (±0.52)	**<0.001**	56.96

≥ 51	0.85 (±0.53)	0.46 (±0.54)	**<0.001**	45.88
Gender				
Male (n=54)	0.77 (±0.54)	0.36 (±0.50)	**<0.001**	53.25
Female (n=32)	0.93 (±0.55)	0.52 (±0.57)	**<0.001**	44.09
Hx of Diabetes				
No DM (n=64)	0.81 (±0.53)	0.34 (±0.44)	**<0.001**	58.02
DM+ (n=26)	0.88 (±0.58)	0.60 (±0.68)	**0.007**	31.82
Hx of Hypertension				
No HTN (n=29)	0.78 (±0.61)	0.40 (±0.59)	**<0.001**	48.72
HTN+ (n=62)	0.85 (±0.51)	0.42 (±0.50)	**<0.001**	50.59
Type of RVO				
BRVO (n=44)	0.67 (±0.47)	0.23 (±0.39)	**<0.001**	65.67
CRVO (n=33)	1.09 (±0.59)	0.65 (±0.58)	**<0.001**	40.37
HRVO (n=9)	0.68 (±0.50)	0.45 (±0.73)	0.233	33.82
Affected Eye				
OD (n=47)	0.84 (±0.58)	0.43 (±0.58)	**<0.001**	48.81
OS (n=44)	0.81 (±0.52)	0.40 (±0.48)	**<0.001**	50.62
Treatment applied				
Avantis (n=56)	0.88 (±0.51)	0.46 (±0.56)	**<0.001**	47.73

Eylea (n=3)	0.49 (±0.44)	0.03 (±0.06)	0.109	93.88
Lucentis (n=31)	0.78 (±0.61)	0.37 (±0.49)	**<0.001**	52.56
Serum Total Cholesterol				
<200 (n=67)	0.86 (±0.56)	0.44 (±0.56)	**<0.001**	48.84
≥200 (n=24)	0.73 (±0.50)	0.33 (±0.43)	**<0.001**	54.79
Serum Triglycerides				
<150 (n=40)	0.78 (±0.54)	0.40 (±0.58)	**<0.001**	48.72
≥150 (n=51)	0.86 (±0.55)	0.43 (±0.48)	**<0.001**	50.00
Serum LDL				
<100 (n=24)	0.90 (±0.55)	0.41 (±0.47)	**<0.001**	54.44
≥100 (n=67)	0.80 (±0.54)	0.42 (±0.55)	**<0.001**	47.50
Serum HDL				
>40 (n=15)	0.73 (±0.52)	0.47 (±0.58)	**0.005**	35.62
≤40 (n=76)	0.84 (±0.55)	0.40 (±0.52)	**<0.001**	52.38

Table 2: Wilcoxon Signed Ranks Test of variables and percentage change between baseline and post-treatment visual acuity.

Variables	Developing BVRO			Improvement in VA		
	OR	**95% CI**	**P value**	**OR**	**95% CI**	**P value**
Age (yrs)						
<50 (ref.)						
≥51	2.08	1.14-3.79	**0.017**	0.81	0.25-2.64	0.722
Gender						
Male (ref.)						
Female	0.74	0.40-1.36	0.328	0.99	0.30-3.26	0.989
Hx of Diabetes						
No DM (ref.)						
DM+	0.67	0.36-1.27	0.220	0.33	0.10-1.07	0.066
Hx of Hypertension						
No HTN (ref.)						
HTN+	6.12	3.18-11.80	**<0.001**	1.28	0.39-4.24	0.686
Type of RVO						
BRVO (ref.)	---	---	---			
CRVO	---	---	---	0.46	0.12-1.79	0.264
HRVO	---	---	---	0.21	0.04-1.15	0.072

Affected Eye						
OD (ref.)	---	---	---			
OS	---	---	---	2.11	0.65-6.88	0.216
Treatment applied						
Avantis (ref.)	---	---	---			
Lucentis	---	---	---	0.69	0.22-2.22	0.539
Serum Total Cholesterol						
<200 (ref.)						
≥200	0.97	0.50-1.88	0.918	1.31	0.33-5.18	0.701
Serum Triglycerides						
<150 (ref.)						
≥150	0.73	0.40-1.34	0.312	1.83	0.58-5.80	0.303
Serum LDL						
<100 (ref.)						
≥100	0.41	0.09-1.98	0.267	0.41	0.09-1.98	0.267
Serum HDL						
>40 (ref.)						
≤40	0.12	0.03-0.55	**0.006**	3.67	1.02-13.18	**0.047**

Table 3: Odds ratio for developing BRVO and improvement in visual acuity of patients with RVO, in relation to the studied variables.

The diagnosis of RVO among patients who were 50 years and older was higher than younger participants (60.44% and 42.35%). The percentage of RVO among males was higher than females (54.63% and 47.06% respectively). In comparison to participants with no history of DM, the diagnosis of RVO did not vary greatly among patients with DM (54.70% for patients without DM and 44.83% for patients with DM). Nevertheless, the difference in proportions for the history of HTN varied greatly with diagnosis of RVO at 73.81% among patients with HTN and at 31.52% among patients with no history of HTN. The commonest type of RVO was BRVO (48.35%), followed by CRVO (36.26%). There was a minor difference in the proportions in relation to the affected eye (OD: 48.35% and OS: 51.65%), and the most common form of treatment was Avantis (62.22%), followed by Lucentis (34.44%). Among lipid profile components studied, the difference in the percentages of RVO in relation to total cholesterol and LDL levels was negligible (serum total cholesterol levels <199: 51.94% and ≥ 200: 51.06%, serum LDL levels <99: 51.06% and ≥ 100: 48.06%). Alarmingly, percentages of RVO were higher among participants with lower triglycerides and higher HDL (serum triglyceride level <150: 56.34% versus ≥ 150: 48.57%, serum HDL level >39: 88.24% versus ≤ 40: 47.80%).

Overall, the visual acuity improved significantly for all participants. This was a consistent finding in all categories of all variables taken into the study, including age, gender, diabetes and hypertension history, types of RVO (except HRVO), affected eye, treatment given (except for Eylea), serum cholesterol, triglycerides, LDL and HDL levels. Patients with BRVO, no history of

DM and age below 50 years of age showed the biggest differences in visual acuity after treatment (65.67%, 58.02% and 56.96% respectively) (Table 2). Nevertheless, the change in visual acuity was found to decrease with age. (Figure 2).

Results demonstrated that patients who were 51 years and older and with history of hypertension were more likely to develop BRVO (age ≥ 51 years: OR=2.08, 95% CI 1.14-3.79, p<0.001; patients with hypertension: OR=6.12, 95% CI 3.18-11.80, p<0.001). However, the results from this study showed that HDL levels ≤40 were less likely to develop BRVO compared to those having higher levels of HDL (OR=0.12, 95% CI 0.03-0.55, p=0.006). For improvement of visual acuity post-treatment, having HDL levels ≤40 was associated with more likelihood of improvement with OR=3.67 (95 CI: 1.02-13.18, p=0.047). There were no associations with age, gender, medical history of hypertension and diabetes, type of RVO, treatment applied, affected eye and other parameters of lipid profile (Table 3).

Discussion:

Retinal Vein Occlusion (RVO) occurs when veins that bring blood to the retina are blocked, affecting blood supply. This study investigated different age groups, RVO patterns, treatment efficacy, and risk factors. This study brings out a better knowledge of RVO with therapeutic options.

Our study found more RVO in people 50 and older (60.44%), similar to Asia and Europe research. Men (54.63%) have a slightly higher prevalence than women. A study conducted in Nepal revealed similar results and demonstrated RVO in ages ranging from 60 to 95 years with a mean age of 69.64 ± 7.31 years. The risk of RVO increases with aging and was more among males. (Thapa et al., 2017).

Throughout the world, there were several types of RVO noticed based on the type of vein affected and the severity of the condition. Our findings coincide with European research on branch retinal vein occlusion (BRVO) which is the leading type (48.35%). These findings are also demonstrated in Ho et al. (2016) where the prevalence of any RVO is 5.20 per 1000, branch RVO is 4.42 per 1000 and central RVO is 0.80 per 1000.

In patients with BRVO, the treatment outcomes are effective by observing visual acuity. Our findings have similar results with other researchers in applying Avantis, Eylea, and Lucentis in therapy.

Several researches observed that the deposition of lipids in the blood vessel is a major risk factor for developing RVO. Our study noticed that lower RVO cases are linked with high levels of serum high-density lipoprotein (HDL). However, a European study emphasized that hypertension is a major contributor to RVO. Battagliola et al. (2021) found older age, active smoking, presence of DMII and glaucoma, all as factors that increased the risk of developing CRVO.

Our findings on visual acuity improvement and BRVO align with European research. Another research pointed out that high levels of HDL have the protecting ability against BRVO. This researcher also stated that there is a complex relationship between lipids and the development of RVO.

Wong, et al (2020) investigated that there was a wide range of predisposing factors that may play a vital role in the progression of RVO.

A Japanese research showed different types of RVO prevalent in Asian countries. We noticed that our observations are similar to the Asian studies.

This research showed that BRVO patients (non-diabetics and < 50 years of age) exhibited substantial improvements in visual acuity. The visual acuity percentages of these patients are 65.67%, 58.02%, and 56.96%, respectively (refer to Table 2). We observed that RVO cases were common among older patients with the decrease in visual acuity.

Furthermore, our results indicated that patients aged 51 years and older, along with a history of hypertension, were more likely to develop BRVO. Specifically, individuals aged 51 years or older had an odds ratio (OR) of 2.08 (95% CI 1.14-3.79, $p<0.001$), while those with a history of hypertension exhibited an OR of 6.12 (95% CI 3.18-11.80, $p<0.001$). Interestingly, individuals with HDL levels ≤ 40 were found to be less likely to develop BRVO compared to those with higher HDL levels, with an OR of 0.12 (95% CI 0.03-0.55, $p=0.006$). These findings coincide with Ponto et al. (2015) which found BRVO was highly associated with arterial hypertension.

Regarding the improvement of visual acuity post-treatment, individuals with HDL levels ≤ 40 were associated with a higher likelihood of improvement, indicated by an OR of 3.67 (95% CI: 1.02-13.18, $p=0.047$). However, no significant associations were found with other parameters, including age, gender, medical history of hypertension and diabetes, type of RVO, treatment applied, affected eye, and additional lipid profile parameters (refer to Table 3).

These findings contribute valuable insights into the factors influencing visual acuity improvement and the development of BRVO. The identification of age, hypertension history, and HDL levels as significant factors provides clinicians with important considerations for assessing and managing patients with RVO. However, further research is warranted to delve deeper into the complex interplay of these factors and their impact on RVO outcomes. The limitations of our study should also be acknowledged, and future investigations may explore additional variables to enhance our understanding of RVO.

Conclusion:

Retinal vein occlusion (RVO) is a serious ophthalmic condition characterized by occlusion in blood vessels from the retina. It can present with other complications like severe swelling, edema, and hemorrhage. RVO is prevalent in developed countries and it is common in developing countries. Retinal vein occlusion requires immediate therapy otherwise it may lead to loss of vision. With advances in ophthalmology, currently, there are many effective treatment options.

Conflict of Interest:

There are no conflicts of interest.

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