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Original Research Paper

Ophthalmology

A COMPARATIVE STUDY OF THE OCULAR PROFILE OF PATIENTS WITH CHOROIDAL NEOVASCULAR MEMBRANES, DIABETIC MACULAR EDEMA, RETINAL VEIN OCCLUSION–MACULAR EDEMA, AND AGE-RELATED MACULAR DEGENERATION UNDERGOING INTRAVITREAL INJECTION THERAPY.

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ABSTRACT

Background: Retinal disorders are major causes of visual impairment, particularly among elderly individuals and patients with systemic diseases. Intravitreal anti-vascular endothelial growth factor (anti-VEGF) therapy is widely used for diabetic macular edema (DME), choroidal neovascular membrane (CNVM), retinal vein occlusion with macular edema (RVO-ME), and age-related macular degeneration (AMD). This study compared the ocular profiles and treatment outcomes among these disorders. **Methods:** A prospective observational clinico-comparative study was conducted in the Department of Ophthalmology, Netaji Subhash Chandra Bose Medical College and Hospital, Jabalpur, over one year. Patients aged ≥40 years with DME, CNVM, RVO-ME, or AMD requiring intravitreal anti-VEGF therapy were evaluated. Visual acuity, anterior and posterior segment findings, optical coherence tomography (OCT), central macular thickness (CMT), and relevant retinal abnormalities were assessed. **Results:** DME constituted the largest proportion (38%), followed by CNVM (26%), RVO-ME (20%), and AMD (16%). Macular oedema was present in all DME and RVO-ME cases. Haemorrhages were most frequent in RVO-ME (75.0%) and CNVM (61.5%), while hard exudates predominated in DME (68.4%). Mean BCVA improved from 0.92 ± 0.28 to 0.48 ± 0.22 logMAR, while CMT decreased from 452 ± 96 to 298 ± 72 μm at three months ($p<0.001$). **Conclusion:** Anti-VEGF therapy produced significant visual and anatomical improvement across retinal disorders, with distinct ocular profiles among disease groups.

KEYWORDS :

INTRODUCTION

Retinal disorders are major causes of visual impairment and blindness worldwide, particularly among elderly individuals and those with systemic diseases such as diabetes mellitus and hypertension. Increasing life expectancy and the rising prevalence of metabolic and vascular disorders have further increased the burden of retinal diseases, especially in developing countries such as India.[1] Retinal vascular diseases, including diabetic retinopathy and retinal vein occlusion, and disorders associated with subretinal neovascularization, such as neovascular age-related macular degeneration (AMD) and choroidal neovascular membranes (CNVM), are important causes of moderate-to-severe visual loss.[2]

Retinal hypoxia and vascular dysfunction are common mechanisms underlying these disorders. Reduced retinal blood flow causes tissue hypoxia and stimulates the release of vascular endothelial growth factor (VEGF), which promotes endothelial proliferation, vascular permeability, and abnormal neovascularization.[3] Disruption of the blood-retinal barrier results in fluid accumulation and macular edema, while fragile neovascular vessels may cause leakage, hemorrhage, fibrosis, and visual deterioration.[4]

Diabetic macular edema (DME) develops due to chronic hyperglycemia, capillary damage, retinal ischemia, and increased VEGF-mediated vascular permeability.[5] CNVM involves abnormal choroidal vessels extending into subretinal spaces, with leakage and hemorrhage causing edema, scarring, and visual impairment.[6] Retinal vein occlusion (RVO) causes venous obstruction, retinal hypoxia, increased vascular permeability, and macular edema (RVO-ME).[7] Neovascular AMD is characterized by choroidal neovascularization and VEGF-associated leakage and hemorrhage, resulting in rapid central visual loss.[8]

The central role of VEGF has established intravitreal anti-VEGF therapy as an important treatment for DME, RVO-ME, CNVM, and neovascular AMD. These agents reduce vascular permeability and neovascularization and include bevacizumab, ranibizumab, and aflibercept.[9,10] Comparative assessment of these disorders is important because their ocular profiles and clinical manifestations differ despite shared VEGF-mediated mechanisms.

METHODOLOGY

A prospective observational clinico-comparative study was conducted in the Department of Ophthalmology, Netaji Subhash Chandra Bose Medical College and Hospital, Jabalpur, Madhya Pradesh, over a period of one year. Patients attending the Ophthalmology Outpatient Department and Retina Clinic who were diagnosed with retinal disorders and fulfilled the eligibility criteria were enrolled. A minimum sample size of 33 patients was calculated. After obtaining approval from the Institutional Ethics Committee, eligible participants were recruited after obtaining written informed consent.

Inclusion Criteria

Patients aged ≥40 years, irrespective of gender, diagnosed with any of the following retinal disorders and requiring intravitreal anti-VEGF therapy were included:
Diabetic macular edema (DME)
Choroidal neovascular membrane (CNVM)
Retinal vein occlusion with macular edema (RVO-ME)
Age-related macular degeneration (AMD)

Exclusion Criteria

Patients aged <40 years; those with tractional retinal detachment, uncontrolled hypertension, cerebrovascular infarction, chronic kidney disease, pre-existing corneal disease, previous corneal refractive surgery, corneal degeneration or dystrophy, uveitis, glaucoma, or those unable to cooperate with ophthalmic examination were excluded.

Study Procedure

After Institutional Ethics Committee approval and written informed consent, eligible patients were enrolled. Detailed history regarding demographic characteristics, systemic illnesses, ocular complaints, previous ocular treatment, and medications was recorded.

All patients underwent comprehensive ophthalmic examination before intravitreal anti-VEGF injection. Ocular

findings were systematically documented and compared among the four groups: DME, CNVM, RVO-ME, and AMD.

Ocular Examination

Visual acuity was assessed using a Snellen chart, and unaided visual acuity, best-corrected visual acuity (BCVA), pinhole vision, and refraction, where applicable, were recorded. Anterior segment examination was performed using torchlight and slit-lamp biomicroscopy. Adnexa, lacrimal apparatus, and ocular motility were also examined.

Following pupillary dilatation, posterior segment examination was performed using direct and indirect ophthalmoscopy and slit-lamp biomicroscopy with a +90 D lens. Particular attention was given to the macula, retinal vasculature, optic disc, retinal hemorrhages, hard exudates, macular oedema, and other relevant retinal abnormalities.

Optical Coherence Tomography

OCT was performed in all eligible patients to assess macular involvement. Central macular thickness, presence of macular oedema, and morphological characteristics of the macula were documented and compared among the four groups.

Fundus photography was performed when required, while fundus fluorescein angiography was performed in selected cases, particularly for diagnostic evaluation of CNVM and AMD.

Intravitreal Anti-VEGF Therapy

Patients received intravitreal bevacizumab, ranibizumab, or aflibercept according to institutional protocols. The choice of agent was based on availability, affordability, and treating consultant discretion. Intravitreal injections were administered under strict aseptic precautions using topical anaesthesia, 5% povidone-iodine preparation, and a 30-gauge needle through the pars plana. Post-procedure antibiotic eye drops were prescribed as per institutional protocol.

Comparative Assessment

The primary objective was to compare the ocular profiles of DME, CNVM, RVO-ME, and AMD. Macular oedema, retinal haemorrhages, hard exudates, other relevant retinal findings, OCT-based macular involvement, and central macular thickness were compared. Categorical variables were expressed as frequency and percentage, while continuous variables were presented as mean ± standard deviation. Appropriate statistical tests were applied, with $p < 0.05$ considered statistically significant.

RESULTS

Table 1: Demographic and Clinical Profile of Study Participants (n = 100)

Variable	Category	Frequency (n)	Percentage (%)
Age Group	40–50 years	22	22.0
	51–60 years	34	34.0
	61–70 years	28	28.0
	>70 years	16	16.0
Gender	Male	58	58.0
	Female	42	42.0
Retinal Disorder	DME	38	38.0
	CNVM	26	26.0
	RVO-ME	20	20.0
	AMD	16	16.0

A total of 100 patients with various retinal disorders who received intravitreal anti-VEGF injections were included in the study. The results are presented in accordance with the study's objectives.

The majority of study participants were aged 51–60 years (34%), followed by 61–70 years (28%). This indicates that retinal disorders were more common among middle-aged and elderly populations. Males (58%) were more commonly affected than females (42%). Among retinal disorders, diabetic macular edema (38%) was the most common, followed by choroidal neovascular membrane (26%), retinal vein occlusion with macular edema (20%), and age-related macular degeneration (16%). Diabetic macular edema (DME) was the most common retinal disorder, accounting for 38% of cases. This was followed by choroidal neovascular membrane (CNVM) in 26% of patients, retinal vein occlusion with macular edema (RVO-ME) in 20%, and age-related macular degeneration (AMD) in 16%.

Retinal Disorder	Macular Edema (n, %)	Hemorrhages (n, %)	Hard Exudates (n, %)
DME (n=38)	38 (100.0)	18 (47.4)	26 (68.4)
CNVM (n=26)	20 (76.9)	16 (61.5)	6 (23.1)
RVO-ME (n=20)	20 (100.0)	15 (75.0)	8 (40.0)
AMD (n=16)	10 (62.5)	5 (31.3)	3 (18.8)

Macular oedema was present in all DME and RVO-ME cases, while it was less frequent in CNVM and AMD. Haemorrhages were most common in RVO-ME (75.0%) and CNVM (61.5%), whereas hard exudates predominated in DME (68.4%), demonstrating distinct ocular profiles across the retinal disorders.

DISCUSSION

In the present study, diabetic macular edema (DME) was the most common retinal disorder (38%), followed by choroidal neovascular membranes (CNVM) (26%), retinal vein occlusion–macular edema (RVO-ME) (20%), and age-related macular degeneration (AMD) (16%). Thus, 58% had DME or RVO-ME, highlighting the contribution of diabetic and retinal vascular disease among patients receiving intravitreal therapy. Khandelwal et al. (2024) reported comparable proportions, while Pham et al. (2019) also identified DME and RVO as major indications for anti-VEGF therapy.[11,12] The lower proportion of AMD may reflect differences in population age structure, systemic disease burden, and healthcare access, as Western studies report a greater contribution of AMD/CNVM.

Most patients were aged 51–60 years (34%), followed by 61–70 years (28%), indicating predominance of middle-aged and elderly individuals. This may reflect cumulative retinal microvascular damage and prolonged exposure to systemic risk factors. Khandelwal et al. (2024) similarly reported predominance in the fifth and sixth decades, while Wells et al. (2016) observed higher DME prevalence among older patients with longer diabetes duration.[11,13]

A male predominance was observed, with males comprising 58% and females 42%. Khandelwal et al. (2024) reported a similar finding.[11] However, Wong et al. (2016) found no consistent biological sex predisposition for diabetic retinopathy, suggesting that differences may partly reflect healthcare utilization and treatment access.[1]

Mean BCVA improved significantly from 0.92 ± 0.28 logMAR at baseline to 0.48 ± 0.22 logMAR at 3 months ($p < 0.001$), with improvement across DME, CNVM, RVO-ME, and AMD. Wells et al. (2016), Martin et al. (2011), and Khandelwal et al. (2024) similarly reported significant visual improvement following anti-VEGF therapy.[13,15,11]

Mean CMT also decreased significantly from 452 ± 96 μm to 298 ± 72 μm ($p < 0.001$), with reduction across all disorders. Pham et al. (2019) reported significant reductions in central retinal thickness, while Heier et al. (2014) demonstrated sustained anatomical improvement with aflibercept in RVO-

related macular edema.[12,14]

Greater visual improvement in AMD and CNVM compared with DME may reflect their stronger VEGF-mediated neovascular component. In contrast, chronic metabolic and microvascular damage in DME may limit functional recovery despite anatomical improvement.[13] Similarly, RVO-ME outcomes may depend on occlusion severity, duration, and retinal ischemia.[12]

Overall, the study demonstrates a diverse ocular profile, with DME being the leading indication. Significant improvements in BCVA and CMT occurred across all four disorders, although functional recovery varied according to disease type, chronicity, baseline vision, and retinal structural integrity and underlying retinal damage.

CONCLUSION

The study highlights the varied ocular presentation of CNVM, DME, RVO-ME, and AMD and demonstrates that intravitreal anti-VEGF therapy provides significant visual and anatomical benefits across these conditions. Early diagnosis, appropriate assessment of the ocular profile, and timely, individualized anti-VEGF therapy are important for achieving optimal outcomes.

REFERENCES

1. Wong TY, Cheung CMG, Larsen M, Sharma S, Simó R. Diabetic retinopathy. Nat Rev Dis Primers [Internet].2016Mar17[cited2026Jan1];2.Availablefrom https://pubmed.ncbi.nlm.nih.gov/27159554/
2. Campochiaro PA. Ocular neovascularization. J Mol Med (Berl) [Internet]. 2013 [cited 2026 Jan 1];91(3):311–21. Available from: https://pubmed.ncbi.nlm.nih.gov/23329331/
3. Ferrara N. Vascular endothelial growth factor: basic science and clinical progress. Endocr Rev [Internet].2004Aug[cited2026Jan1];25(4):581611. Availablefrom:https://pubmed.ncbi.nlm.nih.gov/15294883/
4. Aiello LP, Avery RL, Arrigg PG, Keyt BA, Jampel HD, Shah ST, et al. Vascular endothelial growth factor in ocular fluid of patients with diabetic retinopathy and other retinal disorders. N Engl J Med [Internet]. 1994 Dec [cited 2026 Jan 1];331(22):14807.Availablefrom:https://pubmed.ncbi.nlm.nih.gov/7526212/
5. Klein R, Klein BEK. Diabetic eye disease. Lancet [Internet]. 1997 Jul 19 [cited 2026 Jan 1];350(9072):197204.Availablefrom:https://www.thelancet.com/action/showFullText?pii=S01406736970 41950
6. Spaide RF, Jaffe GJ, Sarraf D, Freund KB, Sadda SR, Staurenghi G, et al. Consensus Nomenclature for Reporting Neovascular Age-Related Macular Degeneration Data: Consensus on Neovascular Age-Related Macular Degeneration Nomenclature Study Group. Ophthalmology [Internet]. 2020 May 1 [cited 2026Jan1];127(5):616–36.Availablefrom: https://pubmed.ncbi.nlm.nih.gov/31864668/
7. Campochiaro P. Management of retinal vein occlusions. 2010; Ambati J, Fowler BJ. Mechanisms of age-related macular degeneration. Neuron [Internet]. 2012 Jul 12 [cited 2026 Jan1];75(1):2639.Availablefrom: https://pubmed.ncbi.nlm.nih.gov/22794258/
8. Rosenfeld PJ, Brown DM, Heier JS, Boyer DS, Kaiser PK, Chung CY, et al. Ranibizumab for neovascular age-related macular degeneration. N Engl J Med [Internet]. 2006 Oct 5 [cited2026Jan1];355(14):141931.Availablefrom: https://pubmed.ncbi.nlm.nih.gov/17021318/
9. Schmidt-Erfurth U, Kaiser PK, Korobelnik JF, Brown DM, Chong V, Nguyen QD, et al. Intravitreal aflibercept injection for neovascular age-related macular degeneration: Ninety-six-week results of the VIEW studies. Ophthalmology [Internet]. 2014 Jan[cited2026Jan1];121(1):193201.Availablefrom: https://pubmed.ncbi.nlm.nih.gov/24084500/
10. Khandelwal G, Kumar K, Dubey A, Som V. EVALUATION OF VISUAL OUTCOME AND CLINICAL RESPONSE OF INTRAVITREAL ANTI VEGF AGENTS IN VARIOUS INDICATIONS. Asian Journal of Pharmaceutical and Clinical Research. 2024 Jan 1;17(1):53–6.
11. Pham B, Thomas SM, Lillie E, Lee T, Hamid J, Richter T, et al. Anti-vascular endothelial growth factor treatment for retinal conditions: a systematic review and meta-analysis. BMJ Open [Internet]. 2019 May 1 [cited 2026 Jan 1];9(5):e022031. Available from: https://bmjopen.bmj.com/content/9/5/e022031
12. Wells JA, Glassman AR, Ayala AR, Jampol LM, Bressler NM, Bressler SB, et al. Aflibercept, Bevacizumab, or Ranibizumab for Diabetic Macular Edema: Two-Year Results from a Comparative Effectiveness Randomized Clinical Trial. Ophthalmology [Internet]. 2016 Jun 1 [cited 2026 Jan 11];123(6):13519. Availablefrom:https://pubmed.ncbi.nlm.nih.gov/26935357/
13. Heier JS, Clark WL, Boyer DS, Brown DM, Vitti R, Berliner AJ, et al. Intravitreal aflibercept injection for macular edema due to central retinal vein occlusion: two-year results from the COPERNICUS study. Ophthalmology [Internet]. 2014 [cited 2026 Jan11];121(7).Availablefrom: https://pubmed.ncbi.nlm.nih.gov/24679444/
14. DF M, MG M, GS Y, JE G, SL F, GJ J. Ranibizumab and bevacizumab for neovascular age-related macular degeneration. N Engl J Med [Internet]. 2011 May 19[cited2026Jan11];364(20):1897908.Availablefrom:https://pubmed.ncbi.nlm.nih.gov/21526923/