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PREVALENCE AND DEMOGRAPHIC PATTERNS OF DIABETIC RETINOPATHY, RETINAL VEIN OCCLUSION, AND AGE-RELATED MACULAR DEGENERATION IN EASTERN INDIA: AN EPIDEMIOLOGICAL STUDY.

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Abstract

***Introduction*:** *To elucidate the epidemiology, clinical characteristics, and treatment outcomes of retinal diseases in Eastern India.*

Methods: *This prospective observational study was conducted at a tertiary care hospital from August 2021 to December 2022. Adult patients (≥18 years) diagnosed with diabetic retinopathy (DR), retinal vein occlusion (RVO), or age-related macular degeneration (ARMD) were enrolled after obtaining informed consent. Comprehensive data collection, including demographic information, clinical characteristics, and treatment outcomes, was conducted. Data were analyzed using descriptive and inferential statistical methods.*

***Results*:** *The study cohort (N=812) exhibited a predominance of DR (60.84%, 95% CI: 57.4-64.2%), followed by branch retinal vein occlusion (BRVO, 18.72%, 95% CI: 16.1-21.6%), ARMD (12.07%, 95% CI: 10.0-14.5%), and central retinal vein occlusion (CRVO, 11.08%, 95% CI: 9.1-13.4%). Demographic analysis revealed a male predominance (73.65%, 95% CI: 70.5-76.6%) and a younger population (60.3% ≤60 years, 95% CI: 56.9-63.6%). Comorbidities were highly prevalent, with diabetes mellitus (69.83%, 95% CI: 66.6-72.9%) and hypertension (58.99%, 95% CI: 55.6-62.3%) being the most common. Clinical evaluation showed decreased vision as the primary symptom (97.17%, 95% CI: 95.8-98.1%). Best Corrected Visual Acuity (BCVA) of 0.5 or better was observed in 52.1% of patients (95% CI: 48.7-55.5%). Optical Coherence Tomography revealed Central Macular Thickness exceeding 300 µm in 34.62% of cases (95% CI: 31.4-37.9%). Laser therapy was the predominant treatment modality (11.13%, 95% CI: 9.2-13.4%). Follow-up adherence demonstrated a significant decline after the initial visit (from 76.13% to 16.77%, p<0.001).*

Conclusion: *This study highlights the urgent need for enhanced screening protocols and multidisciplinary management strategies in Eastern India to address the high burden of retinal diseases. Targeted interventions in this region could prevent vision loss and improve healthcare outcomes.*

Keywords: Retinal disease, Comorbidities, Management, Eastern India **Cite This Article**: SINHA, Bibhuti Prassan et al. Prevalence and Demographic Patterns of Diabetic Retinopathy, Retinal Vein Occlusion, and Age-Related Macular Degeneration in Eastern India: An Epidemiological Study.. **International Journal of Retina**, [S.l.], v. 8, n. 1, p. 15, mar. 2025. ISSN 2614-8536. Available at: <https://www.ijretina.com/index.php/ijretina/article/view/307>. Date accessed: 04 mar. 2025. doi: https://doi.org/10.35479/ijretina.2025.vol008.iss001.307.

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INTRODUCTION

Retinal diseases including DR, BRVO, CRVO, and ARMD have significantly contributed to visual impairment and blindness worldwide. Globally, diabetic retinopathy had been identified as a major cause of vision loss among working-age adults, affecting nearly one-third of individuals with diabetes mellitus [1]. This condition evolved from non-proliferative to proliferative statuses and was accompanied by such complications as macular edema and vitreous hemorrhage [2]. Likewise, in BRVO and CRVO, which were previously reported to be associated with systemic diseases like hypertension and diabetes, the clinical features resulted in vision loss manifesting in the form of retinal ischemia and macular edema [3, 4]. Wet age-related macular degeneration was identified as one of the main causes of central vision loss in elderly population as the rates of the disease grew with the advancement of age [5].

The prevalence of these retinal diseases in India had been made worse by incidences of diabetes as well as aging. The country was confronted to massive cast of diabetic retinopathy following several millions people with diabetes mellitus in the world [6]. Moreover, BRVO and CRVO had been considered significant due to the rising rate of hypertension and diabetes among the Indian adult population [7]. ARMD also translate to becoming a major problem because of the enhancement of life and altered lifestyles [8].

Among the comorbidities that had also affected the clinical features and the management of retinal diseases were diabetes mellitus (DM), hypertension (HTN) and cardiovascular diseases (CAD). Recording these co morbidities and their effect on ocular symptoms like vision acuity and pain was of significant value given the holistic nature of the patients' health [9]. Moreover, there was the need to assess the success rates of the various treatment modalities such as laser therapy and vitrectomy and the rates of improvement in visual acuity as well as the progression of the disease in order to enhance clinicians' use of these treatment interventions to accomplish the best outcomes for their patients [10, 11].

While the global burden of retinal diseases is well-documented, limited epidemiological data exists for Eastern India, a region with unique socio-economic challenges and barriers to healthcare. This study aims to fill this gap by analyzing the prevalence and demographic patterns of retinal diseases in this underserved region.

METHODS

Study Design and Setting: This prospective and cross sectional study was conducted at a tertiary care hospital serving the eastern part of India. The study period spanned from August 2021 to December 2022. The study protocol was approved by the institutional ethics committee (117/IEC/IGIMS/2021), and the research adhered to the tenets of the Declaration of Helsinki.

Patient Selection and Sampling: Adult patients (≥18 years) diagnosed with DR, RVO (BRVO or CRVO), or ARMD who visited the outpatient and special clinics of the ophthalmology department were eligible for inclusion. Individuals who declined to participate or were unable to continue participation were excluded. The diagnosis was confirmed by a consultant ophthalmologist based on comprehensive ophthalmic examination and imaging studies. We employed a consecutive sampling method, enrolling all eligible patients who provided written informed consent during the study period. This study adhered to the tenets of the Declaration of Helsinki.

Data Collection: After obtaining written informed consent, trained research assistants collected demographic data, anthropometric measurements, and medical history using standardized case report forms (CRFs). The following information was recorded: demographic data (gender and sex), comorbidities, ocular history, comprehensive ophthalmic examination, including: BCVA measurement using a Snellen chart, converted to logMAR for analysis, slit-lamp and examination, dilated fundus examination using indirect ophthalmoscopy and slit-lamp biomicroscopy with a 90D lens. Ocular Imaging using: Color fundus photography was performed using a Topcon TRC-50DX retinal camera (Topcon Corporation, Tokyo, Japan). Optical Coherence Tomography (OCT) was performed Topcon Corporation, Tokyo, Japan. Central macular thickness (CMT) and central subfield thickness (CSFT) were measured using the built-in software.

Treatment and Follow-up: Treatment decisions were made by the treating ophthalmologist based on current clinical guidelines. Treatment modalities included laser photocoagulation, intravitreal injections, and vitrectomy. Patients were followed up at 3, 6, and 12 months post-treatment, or more frequently if clinically indicated.

Statistical analysis: Descriptive statistics were calculated using SPSS version 26.0 (IBM Corp., Armonk, NY). Continuous variables were presented as means with standard deviations or medians with interquartile ranges, depending on the distribution of data. Categorical variables were presented as frequencies and percentages. Confidence intervals (95% CI) were computed for key percentages using the Wilson score method. Chi-square tests were used to compare proportions between groups, with a significance level set at $p<0.05$. Trends in follow-up adherence were analyzed using the Cochran-Armitage test for trend.

RESULTS

Prevalence and Distribution of Retinal Diseases

A total of 812 subjects were enrolled in the study between August 2021 and December 2022. DR was the most prevalent retinal disease, affecting 494 individuals (60.84%, 95% CI: 57.4-64.2%). BRVO was the second most common condition, observed in 152 patients (18.72%, 95% CI: 16.1-21.6%). CRVO was present in 90 cases (11.08%, 95% CI: 9.1-13.4%), while ARMD was noted in 98 patients (12.07%, 95% CI: 10.0-14.5%) as shown in table 1.

Demographic Factors

The demographic analysis indicated a substantial gender imbalance, with males comprising 73.65% of the patient population (95% CI: 70.5-76.6%) compared to 26.35% females (95% CI: 23.4-29.5%). Age distribution showed that 60.3% of patients were 60 years of age or younger (95% CI: 56.9-63.6%), while 39.7% were older than 60 (95% CI: 36.4-43.1%) as shown in table 1.

Table 1: *Statistical summary of Key Retinal Diseases and Demographics*

Category	Subcategory	Number of Patients	Percentage	95% Confidence Interval
Retinal Diseases	DR	494	60.84%	57.4% - 64.2%
	BRVO	152	18.72%	16.1% - 21.6%
	CRVO	90	11.08%	9.1% - 13.4%
	ARMD	98	12.07%	10.0% - 14.5%
Gender	Male	598	73.65%	70.5% - 76.6%
	Female	214	26.35%	23.4% - 29.5%
Age	≤ 60 years	489	60.3%	56.9% - 63.6%
	> 60 years	323	39.7%	36.4% - 43.1%

Comorbidities

Diabetes mellitus was the most prevalent comorbidity, affecting 69.83% (95% CI: 66.6% - 72.9%) of the study population. This high prevalence underscores the strong association between diabetes and retinal diseases, particularly diabetic retinopathy. The vast majority of diabetic patients (99.12%, 95% CI: 97.9% - 99.6%) had Type II diabetes, while only a small fraction (0.88%, 95% CI: 0.4% - 2.1%) had Type I diabetes. Hypertension was the second most common comorbidity, present in 58.99% (95% CI: 55.6% - 62.3%) of patients. Chronic Kidney Disease was observed in 17.00% (95% CI: 14.6% - 19.7%) of the patients. Coronary Artery Disease was present in 7.02% (95% CI: 5.5% - 9.0%) of patients, while 5.67% (95% CI: 4.3% - 7.5%) had a history of stroke. Dyslipidemia was observed in 9.61% (95% CI: 7.8% - 11.8%) of patients. Thyroid-related diseases affected 9.11% (95% CI: 7.3% - 11.3%) of the study population. Among patients with thyroid disorders, hypothyroidism was far more common (89.19%, 95% CI: 80.1% - 94.4%) than hyperthyroidism (10.81%, 95% CI: 5.6% - 19.9%). Strikingly, 86.08% (95% CI: 83.6% - 88.3%) of patients had at least one comorbidity as shown in table 2

***Table 2**: Prevalence of Comorbidities among Patients with Retinal Diseases in Eastern India*

Comorbidity	Number of Patients	Percentage (%)	95% CI
Diabetes Mellitus	567	69.83	66.6% - 72.9%
Type II Diabetes	562	99.12	97.9% - 99.6%
Type I Diabetes	5	0.88	0.4% - 2.1%
Hypertension	479	58.99	55.6% - 62.3%
CAD	57	7.02	5.5% - 9.0%
CKD	138	17.00	14.6% - 19.7%
Dyslipidemia	78	9.61	7.8% - 11.8%
Stroke	46	5.67	4.3% - 7.5%
Thyroid Related Disease	74	9.11	7.3% - 11.3%
Hypothyroidism	66	89.19	80.1% - 94.4%
Hyperthyroidism	8	10.81	5.6% - 19.9%
At least One Comorbidity	699	86.08	83.6% - 88.3%

Ocular History and Symptoms

The symptom profile revealed that decreased vision was the most frequently reported issue, affecting 85.9% of patients. Other symptoms were less common, with watering in only 4.2%, redness 0.8% and flashes in 0.8% of cases. Floaters and pain affected 3.5% and 3.4% of patients, respectively. Symptoms such as photophobia, redness, scotomas, and watering were observed in a small proportion of the cohort, indicating a range of ocular symptoms with decreased vision being the most prevalent concern as shown in figure 1.

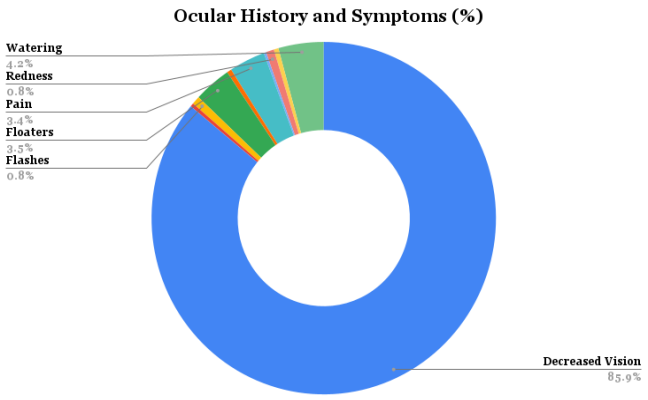

***Figure 1**: Ocular History and Symptoms*

Clinical Characteristics and Biomarkers

Clinical characteristics, as measured by Best Corrected Visual Acuity (BCVA), showed that 52.1% of patients had a BCVA of 0.5 or better, suggesting relatively preserved vision in over half of the cohort. A BCVA between 0.5 and 1.3 was observed in 29.8% of patients, while 18.1% had a BCVA greater than 1.3. OCT findings revealed that 53.41% of patients had a CMT between 5-250 µm, with 34.62% exceeding 300 µm. CSFT data showed that 42.15% of patients had thickness greater than 300 µm, highlighting significant variability in retinal thickness among patients as shown in figure 2.

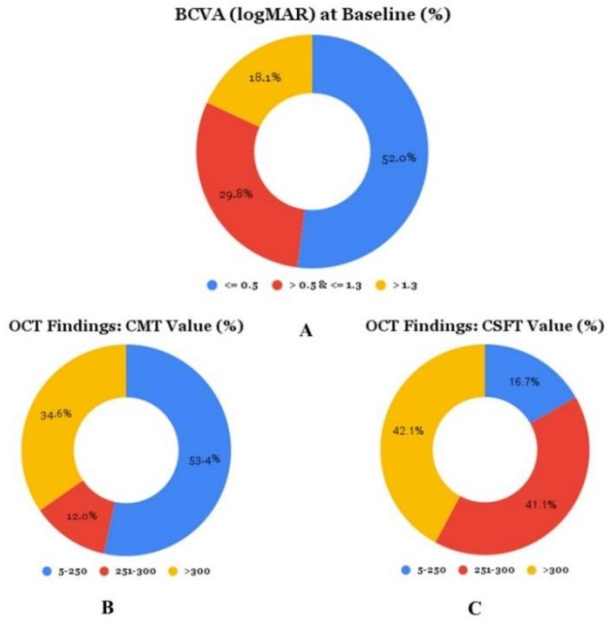

***Figure 2**: Distribution of BCVA at baseline (A) and OCT biomarker (CMT & CSFT) B & C.*

Treatment Modalities and Outcomes

Regarding treatment modalities, laser therapy was the most commonly used intervention, applied in 26.1% of cases. Vitrectomy was utilized in a minimal number of cases (0.5%). Follow-up patterns indicated that 55.9% of patients attended the first follow-up visit, but attendance significantly decreased in subsequent visits, with only 12.3% attending the second follow-up and smaller percentages for the third (3.8%) and fourth (1.4%) visits. This trend highlighted a need for improved follow-up adherence strategies as shown in figure 3.

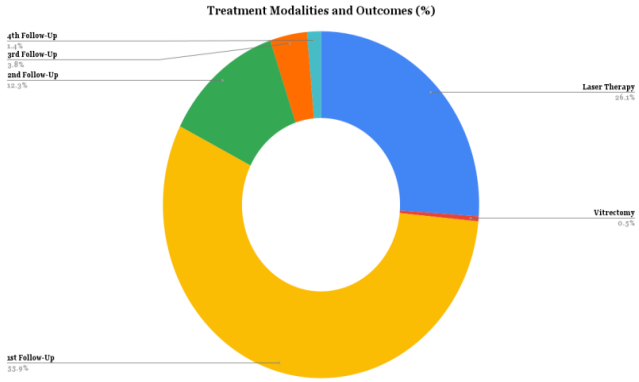

***Figure 3**: Percentage of Treatment Modalities and Outcomes and follow-ups.*

Patterns and Trends in Diagnosis and Management

Diagnosis and management patterns revealed that DR was frequently diagnosed in its moderate form (37.45%), with severe and very severe cases being less common. Branch Retinal Vein BRVO was predominantly non-ischemic (54.61%). For CRVO, ischemic forms were most common (65.56%). ARMD showed a predominance of wet AMD (56.12%), with several subtypes contributing to its overall prevalence. These patterns reflected the diversity and complexity of retinal disease manifestations and management as shown in figure 4 (A-D).

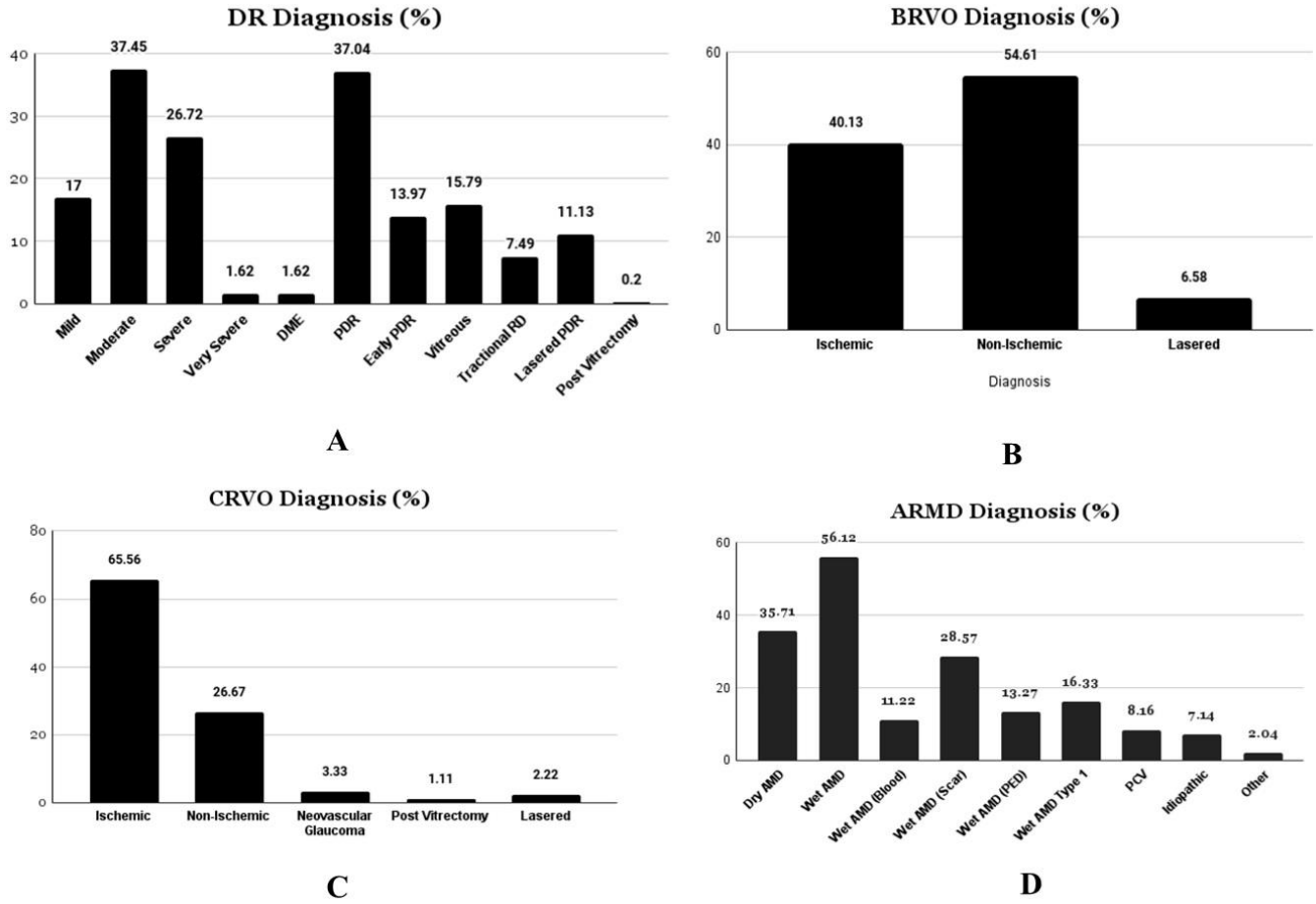

***Figure 4**: Patterns and Trends in Diagnosis and Management of DR (A), BRVO (B), CRVO (C) and ARMD (D).*

DISCUSSION

Our study revealed critical findings in Eastern India's retinal disease landscape: a high prevalence of diabetic retinopathy (60.84%), significant male predominance (73.65%), poor follow-up adherence (declining from 76.13% to 16.77%), and substantial comorbidity burden. The healthcare infrastructure challenges, including limited specialized centers and workforce shortages, likely contribute to these outcomes. These findings have important implications for public health initiatives and clinical practice in the region. This study provides valuable insights into the prevalence and characteristics of retinal diseases in the studied population. The high prevalence of DR at 60.84% aligns with global trends, especially in populations with high diabetes prevalence. Yau et al. (2012) found that the global prevalence of DR among people with diabetes was 34.6%, with higher rates in developing countries [1]. This underscores the importance of diabetes management and regular retinal screening for diabetic patients, as emphasized by the ADA's position statement [2].

The prevalence of BRVO at 18.72% is higher than some global estimates. Song et al. (2019) found that the global prevalence of retinal vein occlusion ranges from 0.3% to 1.6% in older adults [12]. This could suggest a higher risk population in the study area or potential selection bias in the sample. The prevalence of ARMD at 12.07% is within the range found in other studies, though on the higher end.

Wong et al. (2014) estimated a global prevalence of early AMD at 8.01% and late AMD at 0.37% in adults aged 45-85 years [13].

The demographic profile, particularly the gender imbalance with 73.65% male patients, suggests a potential gender bias in healthcare-seeking behavior, as women in rural India may be less likely to seek timely care for eye diseases. Moreover, the poor follow-up adherence underscores the need for targeted interventions, such as telemedicine or mobile health clinics, to improve continuity of care in underserved populations. In contrast, the Wisconsin Epidemiologic Study of Diabetic Retinopathy reported a more balanced gender distribution in their long-term follow-up of individuals with type 1 diabetes [14].

The high rate of comorbidities, especially DM (69.83%), HTN (58.99%), and CKD (17%), emphasizes the need for a multidisciplinary approach to patient care. Cheung et al. (2010) highlighted diabetes and hypertension as major risk factors for retinal diseases [15]. Grunwald et al. (2011) found that CKD is associated with an increased risk of retinal diseases, particularly in diabetic patients [16]. The European Diabetes Working Party for Older People has emphasized the importance of a multidisciplinary approach in their clinical guidelines [17].

The clinical characteristics and OCT findings highlight the advanced stage at which many patients present. The significant proportion of patients with increased retinal thickness (34.62% with CMT >300 µm and 42.15% with CSFT >300 µm) indicates the presence of macular edema, a common complication in many retinal diseases [18]. This suggests a need for earlier detection and intervention. The success of early detection programs, such as the English National Screening Programme for diabetic retinopathy, underscores the potential benefits of such initiatives [19].

The treatment patterns, particularly the relatively low use of laser therapy (11.13%), may indicate a need for reassessment of treatment protocols or improved access to interventions. Current guidelines recommend consideration of laser therapy for proliferative DR and macular edema in certain cases [20]. The low rate of vitrectomy (0.2%) is not unusual, as this is typically reserved for advanced complications of retinal diseases. Gupta et al. (2021) confirmed that vitrectomy is generally used for more severe cases of diabetic macular edema [21]. The identified healthcare challenges suggest several targeted interventions: establishing satellite eye care centers with telemedicine capabilities, implementing mobile screening units for rural areas, and developing patient education programs focused on women and underserved populations. Community health workers could be trained for basic screenings and follow-up coordination, while SMS-based reminder systems could improve adherence rates. These interventions could particularly benefit vulnerable populations who face additional barriers to accessing care.

Perhaps the most pressing issue revealed by this study is the poor follow-up adherence, with a sharp decline in attendance after the first visit. This is a significant concern, as consistent follow-up is crucial for managing chronic retinal diseases effectively. Kang et al. (2020) highlighted the challenges of follow-up adherence in managing chronic retinal diseases [22]. Lawrenson et al. (2018) have reviewed various interventions to increase attendance for diabetic retinopathy screening, which could potentially be applied to improve follow-up adherence in this population [23].

These findings have significant implications for clinical practice and public health in Eastern India. The high prevalence of DR, coupled with poor follow-up adherence, suggests a need for improved diabetes management and

patient education programs. The gender imbalance in our cohort highlights potential barriers to healthcare access for women, which warrants further investigation and targeted interventions. Moreover, the frequent co-occurrence of systemic comorbidities underscores the importance of a multidisciplinary approach to patient care, involving endocrinologists, cardiologists, and nephrologists alongside ophthalmologists.

This study has several limitations that should be considered when interpreting the results. First, as a single-center study, the findings may not be generalizable to the entire Eastern Indian population. Second, the consecutive sampling method may have introduced selection bias, potentially overestimating the prevalence of severe cases. Third, the cross-sectional nature of the study limits our ability to establish causal relationships or assess disease progression over time. Fourth, the study lacked standardized diagnostic criteria and disease severity classifications, limiting comparison with other studies. Future research should investigate socioeconomic barriers to healthcare access, particularly for women, and evaluate intervention strategies to improve patient retention and treatment outcomes in this population. Future longitudinal studies are needed to address these limitations and provide a more comprehensive understanding of retinal disease patterns in this population.

CONCLUSION

In conclusion, this study highlights the significant burden of retinal diseases, particularly DR, in the studied population, emphasizing the need for comprehensive eye care and better management of systemic comorbidities. Future research should explore the factors behind the observed patterns, including gender imbalances and poor follow-up adherence. Longitudinal studies are needed to assess disease progression and treatment outcomes. Furthermore, early detection and intervention through community-based screening programs and integrated multidisciplinary care models could substantially reduce vision loss in Eastern India.

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