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Original Article

Clinical Profile and Fundus Changes in Pathological Myopia: A Prospective Study from South India

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ABSTRACT

Background: Pathological myopia is a progressive degenerative condition associated with significant visual morbidity due to structural changes in the posterior segment of the eye. With increasing prevalence, especially among younger populations, early identification of associated fundus changes and complications is essential for timely intervention and prevention of vision loss.
Methods: This prospective study was conducted over a period of six months (January 2024 to June 2024). A total of 100 patients (200 eyes) with pathological myopia (refractive error > -6.0 D) were included. All patients underwent detailed ophthalmic evaluation including visual acuity assessment, slit-lamp examination, intraocular pressure measurement, A-scan biometry, keratometry, and fundus examination. Patients with abnormal corneal curvature and other ocular pathologies were excluded. Posterior segment changes and peripheral retinal degenerations were documented and analyzed.
Results: The highest incidence of pathological myopia was observed in the 11–20 years age group (32%), with a female predominance (54%). Most patients had a refractive error between -6 D and -9 D (41.5%) and axial length ranging from 26–28 mm (34%). The majority of patients had best corrected visual acuity between 6/6 and 6/18 (60%). Common fundus findings included tessellated fundus (42%), temporal crescent (40%), peripapillary atrophy (25%), and posterior staphyloma (21%). Lacquer cracks were observed in 11% and Fuchs spots in 7.5% of cases. Peripheral retinal degeneration was most commonly lattice degeneration (5%). Complications such as retinal detachment (5%), primary open-angle glaucoma (5%), and retinitis pigmentosa (4%) were also noted.
Conclusion: Pathological myopia is associated with a high prevalence of degenerative fundus changes, particularly in eyes with higher refractive error and axial length. Early detection through meticulous fundus examination and regular follow-up is crucial to prevent vision-threatening complications and preserve visual function.

Keywords: *Pathological myopia, axial length, fundus changes, retinal degeneration, staphyloma.*

INTRODUCTION

Myopia is one of the most common refractive errors worldwide and a leading cause of visual impairment. It is defined as a condition in which parallel rays of light are focused in front of the retina when accommodation is relaxed. While low to moderate myopia is often considered a physiological variation, high myopia (greater than −6.0 diopters) is frequently associated with progressive structural changes in the eye and is termed pathological myopia [1,2].
Pathological myopia is characterized by excessive axial elongation of the eyeball, leading to degenerative changes involving the sclera, choroid, retina, and vitreous. These changes predispose affected individuals to a range of vision-threatening complications such as posterior staphyloma, chorioretinal atrophy, lacquer cracks, choroidal

neovascularization, retinal detachment, and glaucoma [3–5]. The risk and severity of these complications increase with greater axial length and higher refractive error.

Globally, the prevalence of myopia has been increasing at an alarming rate, particularly in Asian populations, where it is emerging as a major public health concern. Pathological myopia contributes significantly to irreversible visual impairment due to progressive macular and retinal damage [6–8]. Studies have shown that the prevalence of high myopia is significantly higher in Asian populations compared to Western populations, highlighting its growing epidemiological importance [7,9]. Advances in diagnostic modalities such as optical coherence tomography (OCT) and fundus imaging have improved the detection and monitoring of myopic degenerative changes. These technologies allow detailed visualization of retinal and choroidal alterations, aiding in early diagnosis and follow-up of complications such as myopic choroidal neovascularization and macular retinoschisis [10,11]. However, clinical fundus examination remains a cornerstone in identifying early pathological changes and guiding management [3].

Despite the increasing burden of myopia, there is limited region-specific data on the clinical profile and spectrum of fundus changes associated with pathological myopia in the Indian population. Understanding these patterns is important for early diagnosis, risk stratification, and timely intervention.

Therefore, the present study was undertaken to analyze the visual parameters, fundus changes, and associated ocular conditions in patients with pathological myopia attending a tertiary care center in Visakhapatnam.

MATERIALS AND METHODS

Study Design and Setting:

This was a prospective observational study conducted over a period of six months (January 2024 to June 2024) at the Department of Ophthalmology, Andhra Medical College, Visakhapatnam.

Study Population:

A total of 100 patients (200 eyes) diagnosed with pathological myopia attending the outpatient department were included in the study.

Inclusion Criteria:

- Patients with refractive error greater than −6.0 diopters
- Axial length ≥24 mm
- Patients willing to participate in the study

Exclusion Criteria:

- Index myopia and congenital myopia
- Abnormal corneal curvature (keratometric abnormalities)
- Associated ocular conditions such as microphthalmos and ectopia lentis
- Media opacities precluding fundus examination

Data Collection and Clinical Evaluation:

A detailed history was obtained including duration of visual complaints, age at onset, spectacle use, and family history of myopia. Symptoms such as progressive diminution of vision, floaters, and flashes were recorded.

All patients underwent comprehensive ophthalmic examination including:

- Measurement of visual acuity using Snellen's chart (uncorrected and best corrected visual acuity)
- Slit-lamp biomicroscopic examination of the anterior segment
- Intraocular pressure measurement using applanation tonometry
- Refraction and retinoscopy

Ocular Investigations:

- **A-scan biometry** was used to measure axial length
- **Keratometry** was performed to assess corneal curvature
- **Fundus examination** was carried out using direct ophthalmoscopy and indirect ophthalmoscopy

Patients with posterior pole abnormalities underwent further evaluation where required. Peripheral retina was examined using indirect ophthalmoscopy and three-mirror contact lens to identify degenerative changes.

Outcome Measures:

The primary outcomes included:

- Distribution of refractive error and axial length

- Best corrected visual acuity (BCVA)
- Posterior segment changes (e.g., tessellation, staphyloma, lacquer cracks)
- Peripheral retinal degenerations (e.g., lattice degeneration)
- Associated ocular complications (e.g., retinal detachment, glaucoma)

Statistical Analysis:
Data were entered and analyzed using descriptive statistics. Results were expressed in terms of frequencies and percentages.

RESULTS

A total of 100 patients (200 eyes) with pathological myopia were included in the study.

Demographic Profile
The highest number of patients belonged to the **11–20 years age group (32%)**, followed by 21–30 years and 31–40 years (24% each). The least number of patients were in the 0–10 years age group (2%).

Table 1: Age Distribution of Patients

Age Group (years)	Number of Patients	Percentage (%)
0–10	2	2
11–20	32	32
21–30	24	24
31–40	24	24
41–50	7	7
>50	10	10

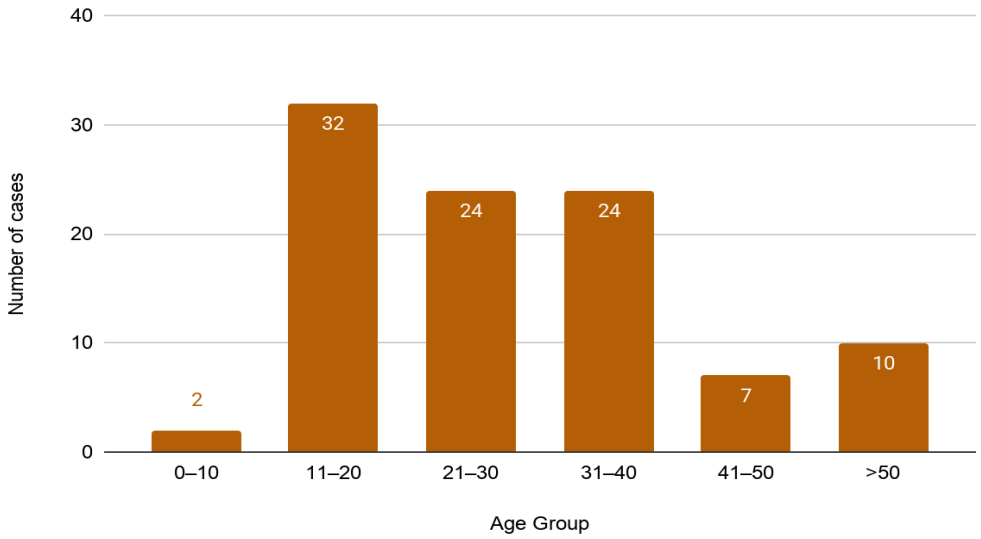

Figure 1: Bar graph showing age distribution

A female predominance was observed, with 54% females and 46% males.

Table 2: Sex Distribution

Sex	Number of Patients	Percentage (%)
Male	46	46
Female	54	54

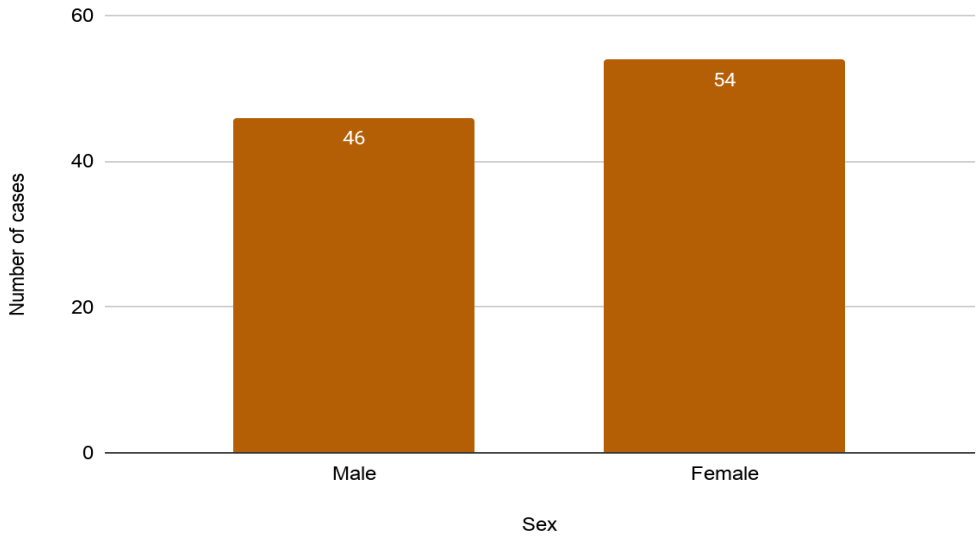

Figure 2: Pie chart showing sex distribution

Only 19% of patients had a positive family history of myopia.

Table 3: Family History of Myopia

Family History	Number of Patients	Percentage (%)
Positive	19	19
Negative	81	81

Visual Acuity and Refractive Status
The majority of patients had poor uncorrected visual acuity, with **51.5% of eyes having CF–CF vision**.

Table 4: Uncorrected Visual Acuity (UCVA)

UCVA	Number of Eyes	Percentage (%)
CF 2M – CF 1M	52	26.5
CF 1/2M – CF 1/2M	39	19.5
CF–CF	103	51.5
PL Positive	4	2
PL Negative	2	1

Most patients had a refractive error between −6 D to −9 D (41.5%).

Table 5: Refractive Status

Refractive Error	Number of Eyes	Percentage (%)
−6 to −9 D	83	41.5
−10 to −14 D	41	20.5
−15 to −18 D	32	16.5
−19 to −22 D	27	13

> −23 D	8	4

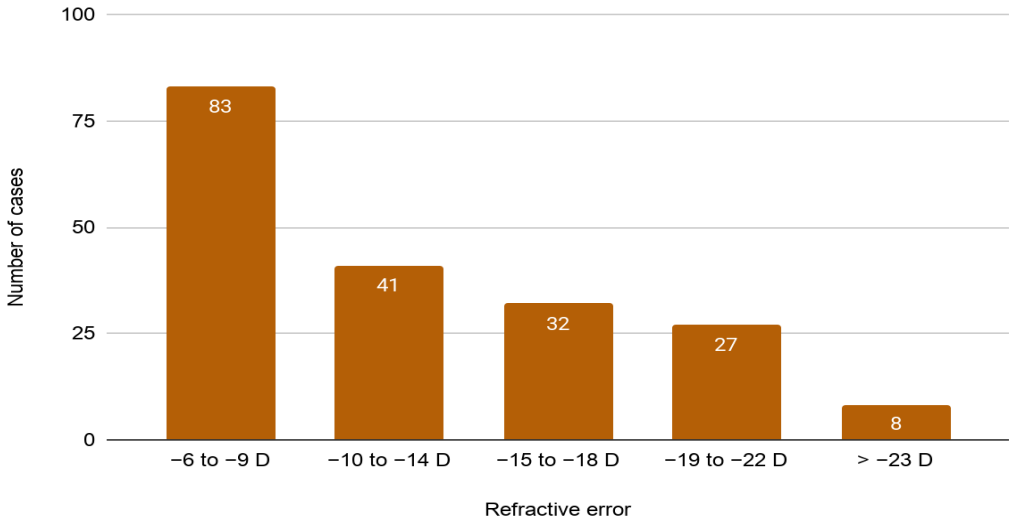

Figure 3: Bar graph showing refractive status

Majority of eyes (**60%**) had best corrected visual acuity between **6/6–6/18**.

Table 6: Best Corrected Visual Acuity (BCVA)

BCVA	Number of Eyes	Percentage (%)
6/6–6/18	120	60
6/24–6/36	21	10.5
6/60–1/60	25	12.5
<1/60	34	17

Axial Length and Intraocular Pressure

Most eyes had an axial length between 26–28 mm (34%), followed by 24–26.99 mm (33%).

Table 7: Axial Length Distribution

Axial Length (mm)	Number of Eyes	Percentage (%)
24–26.99	66	33
27–28.99	64	34
29–30.99	52	26
>31	18	9

The majority of eyes (93%) had normal intraocular pressure, while 5% had elevated IOP (>21 mmHg).

Table 8: Intraocular Pressure (IOP)

IOP (mmHg)	Number of Eyes	Percentage (%)
<10	4	2
10–21	186	93

>21	10	5

Fundus Changes

The most common posterior segment findings were **tigroid fundus (42%) and temporal crescent (40%)**, followed by peripapillary atrophy (25%) and posterior staphyloma (21%).

Table 9: Posterior Segment Changes

Fundus Finding	Number of Eyes	Percentage (%)
Tigroid fundus	84	42
Temporal crescent	80	40
Peripapillary atrophy	50	25
Posterior staphyloma	42	21
Chorioretinal atrophy	28	14
Lacquer cracks	22	11
Fuchs spots	15	7.5

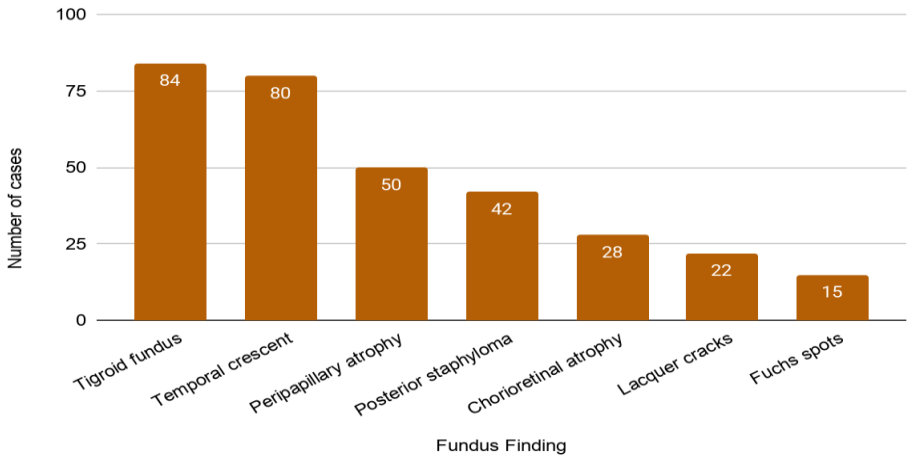

Figure 4: Bar graph showing fundus changes

Peripheral Retinal Degeneration

Lattice degeneration was the most common peripheral retinal change (5%), followed by paving stone degeneration (2.5%).

Table 10: Peripheral Retinal Changes

Finding	Number of Eyes	Percentage (%)
Lattice degeneration	10	5
Paving stone	5	2.5
WWOP	4	2
Snail track	1	0.5
Retinal tear	2	1

Associated Ocular Conditions

Retinal detachment and primary open-angle glaucoma were each observed in **5% of patients**, while retinitis pigmentosa was seen in 4%.

Table 11: Associated Ocular Findings

Condition	Number of Patients	Percentage (%)
Retinal detachment	5	5
Primary open-angle glaucoma	5	5
Retinitis pigmentosa	4	4
Posterior subcapsular cataract	1	1
Strabismus	5	5

Clinical Images

Fundus photographs demonstrating key pathological features of myopia.

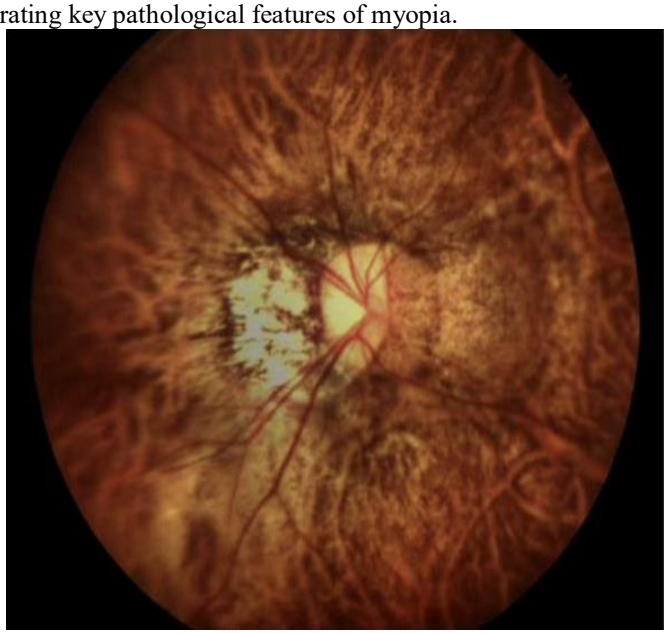

Figure 5: Tessellated back ground and tilted disc

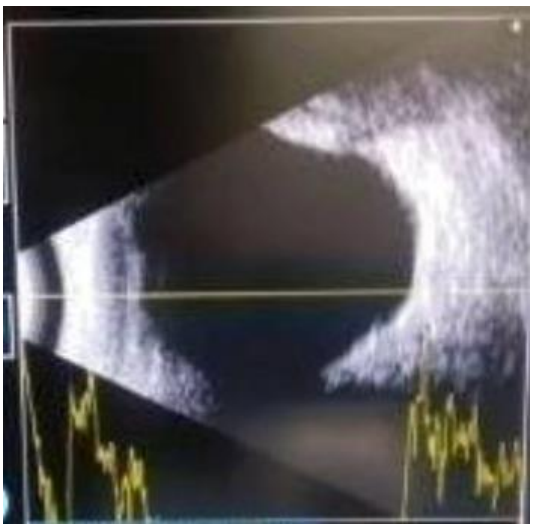

Figure 6: Posterior staphyloma

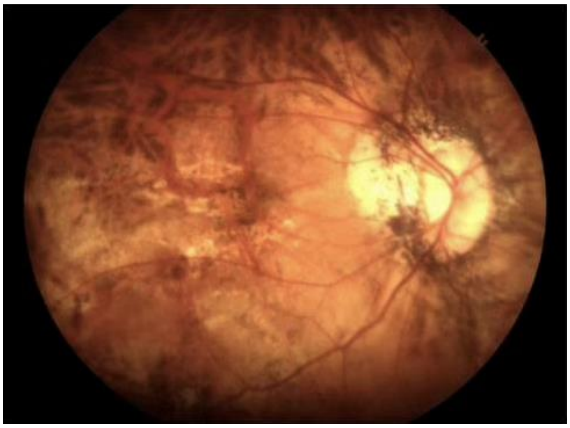

Figure 7: Lacquer cracks

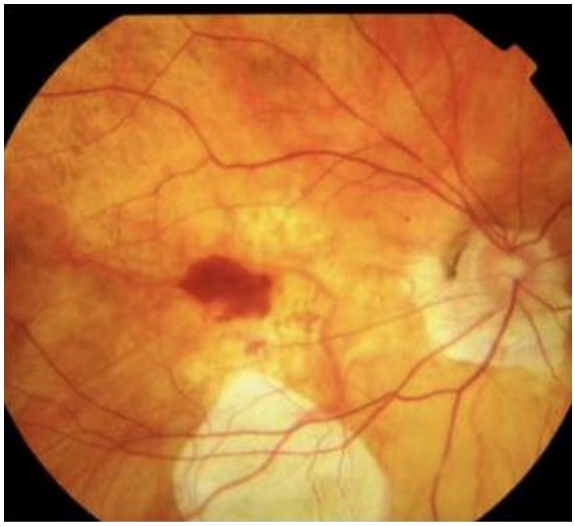

Figure 8: Foster Fuchs spot (CNV)

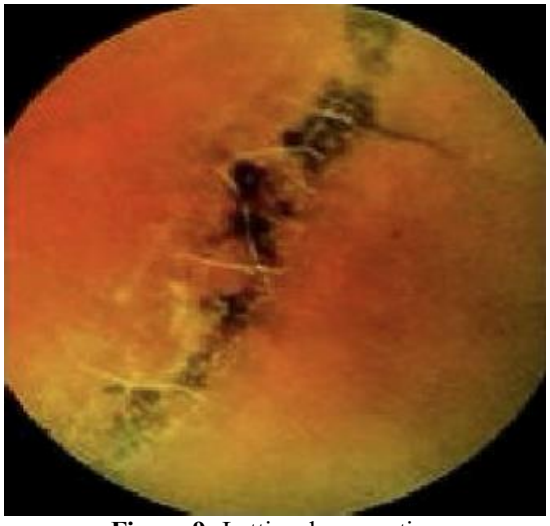

Figure 9: Lattice degeneration

DISCUSSION

Pathological myopia is a major cause of visual impairment worldwide due to its progressive and degenerative nature. The present study evaluated the clinical profile, fundus changes, and associated ocular conditions in patients with pathological myopia in a tertiary care setting in South India.

In this study, the highest incidence of pathological myopia was observed in the 11–20 years age group (32%), indicating early onset and progression during the formative years. This finding is consistent with epidemiological studies from China

and East Asia that report an increasing prevalence of myopia among younger populations [6,7,13]. Environmental factors such as increased near work, digital device use, and reduced outdoor activity are important contributors to this trend [15]. A female predominance (54%) was observed, which is in agreement with findings by Mo et al. from China [14]. Although the exact mechanism remains unclear, it may involve a combination of biological susceptibility and environmental influences.

Only 19% of patients had a positive family history, suggesting that environmental factors may play a significant role in this cohort. Studies such as that by Rose et al. conducted in Australia and Singapore have demonstrated that outdoor activity has a protective effect against myopia progression, supporting the importance of environmental influences [15].

The majority of patients had a refractive error between −6 D to −9 D (41.5%), which is comparable to findings from Indian studies such as that by Venkatesan et al. [16]. In terms of visual function, 60% of eyes had BCVA between 6/6–6/18, indicating that useful vision may be preserved in many patients despite structural changes, particularly in earlier stages of the disease [17].

Axial length plays a central role in the pathogenesis of pathological myopia. In the present study, most eyes had an axial length between 26–28 mm, which is consistent with studies from Japan and East Asia demonstrating a strong association between axial elongation and degenerative changes [11,18].

Fundus examination revealed that tigroid fundus (42%) and temporal crescent (40%) were the most common findings. These features reflect thinning of the retinal pigment epithelium and choroid, which are characteristic of pathological myopia. Posterior staphyloma was observed in 21% of cases, indicating advanced structural changes and correlating with disease severity [11].

Other important findings included lacquer cracks (11%) and Fuchs spots (7.5%), both of which are known precursors to choroidal neovascularization and have been described in studies from Japan and Europe [3,11]. Peripheral retinal degenerations, particularly lattice degeneration (5%), though less frequent, remain clinically significant due to their association with retinal breaks and detachment [4].

Associated ocular complications such as retinal detachment and primary open-angle glaucoma (5% each) further emphasize the importance of regular monitoring in patients with pathological myopia. The association between high myopia and glaucoma has been consistently reported across different populations [3].

Comparison with Previous Studies

Table: Comparison of Present Study with Previous Studies

Study	Location	Study Type	Sample Size	Key Findings	Comparison with Present Study
Present Study	India (Visakhapatnam)	Prospective clinical	100	Tigroid fundus (42%), staphyloma (21%), lattice (5%)	Comprehensive clinical profile
Venkatesan et al. [16]	India	Clinical	100	Tessellation common, RD ~9%	Similar Indian data; lower staphyloma
Mo et al. [14]	China	Clinical	167	Female predominance	Similar gender trend
Chen et al. [13]	China	Epidemiological	Large population	Increasing prevalence in youth	Supports younger age distribution
Rose et al. [15]	Australia & Singapore	Epidemiological	Population-based	Outdoor activity protective	Supports environmental role
Kleinstein et al. [9]	USA	Epidemiological	Multi-ethnic	Ethnic variation	Supports geographic variability
Ohno-Matsui et al. [11]	Japan	Clinical	Large cohort	Axial length linked to maculopathy	Supports axial length correlation

The findings of the present study are broadly consistent with both clinical and epidemiological studies across different populations. The predominance of younger age groups and the influence of environmental factors align with global trends.

The relatively higher incidence of posterior staphyloma observed in this study compared to some Indian studies may be due to differences in patient selection, disease severity, or diagnostic techniques. Variations in peripheral retinal findings may also be attributed to differences in examination methods and study design.

CONCLUSION

Pathological myopia is a progressive degenerative condition associated with significant structural changes in the posterior segment of the eye, leading to visual morbidity. The present study shows that it predominantly affects younger individuals and is characterized by common fundus findings such as tessellated fundus, temporal crescent, and posterior staphyloma, with severity increasing with higher refractive error and axial length. While many patients retained useful vision, a considerable proportion had reduced visual acuity due to macular involvement.

The present study provides a comprehensive clinical evaluation by integrating functional, biometric, and structural parameters, including both posterior and peripheral retinal changes along with associated ocular morbidities. Early detection through meticulous fundus examination and regular follow-up is essential to prevent vision-threatening complications and preserve visual function.

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