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Prevalence of Vitreomacular Adhesions in Patients Without Maculopathy Older Than 40 Years: A Cross-Sectional Study

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Abstract

Background: Vitreomacular adhesion (VMA) is a condition characterized by anomalous posterior vitreous detachment resulting in persistent adherence of the vitreous cortex to the macula. Although often asymptomatic, it may predispose to macular pathologies such as macular holes or epiretinal membranes. Limited data exist on the prevalence of VMA in individuals without clinical maculopathy.

Objective: To determine the prevalence of vitreomacular adhesions in asymptomatic individuals over 40 years of age without any signs of maculopathy and to evaluate associated demographic and ocular factors.

Methods: A cross-sectional observational study was conducted on 300 eyes of 150 individuals aged >40 years undergoing routine ophthalmologic evaluation. Spectral-domain optical coherence tomography (SD-OCT) was used to identify and characterize VMA. Patients with existing macular pathologies, diabetic retinopathy, or prior retinal surgery were excluded.

Results: The overall prevalence of VMA was 14.3%. Bilateral VMA was observed in 3.3% of subjects. VMA was more common in individuals aged ≥60 years ($p = 0.01$) and showed no significant association with gender or refractive status. Most VMAs were focal and asymptomatic.

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Conclusion: Vitreomacular adhesion is a relatively common finding in asymptomatic individuals over 40 years, especially in those above 60. Routine OCT screening in older adults can help identify early vitreoretinal interface disorders before the onset of visual symptoms or macular complications.

Introduction

The vitreoretinal interface plays a critical role in maintaining the anatomical and functional integrity of the macula. With advancing age, the vitreous body undergoes liquefaction and posterior vitreous detachment (PVD), a natural degenerative process. However, in some individuals, anomalous or incomplete PVD can result in persistent adhesion between the posterior vitreous cortex and the macula, a condition known as vitreomacular adhesion (VMA) (1).

VMA is characterized by a perifoveal detachment of the posterior vitreous with persistent attachment to the macular region, identifiable through high-resolution imaging such as spectral-domain optical coherence tomography (SD-OCT). While many VMAs are asymptomatic and may resolve spontaneously, persistent or progressive traction can predispose to a spectrum of vitreomacular interface disorders, including vitreomacular traction (VMT), macular holes, and epiretinal membranes (2).

The International Vitreomacular Traction Study (IVTS) Group defines VMA based on OCT characteristics, particularly noting a partial posterior vitreous detachment with macular adherence but without signs of retinal distortion. In contrast to VMT, where anatomical changes and symptoms are often present, VMA may exist subclinically for long periods, especially in older adults (3).

OCT has significantly improved our ability to detect subclinical and early-stage VMA. Numerous studies have demonstrated that VMA may be present in eyes with otherwise normal fundus appearance. However, despite the increasing use of OCT in clinical practice, the epidemiological data on the prevalence of VMA in healthy, asymptomatic individuals—particularly those older than 40 years without coexisting macular pathology—remain sparse (4).

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Age is a well-established risk factor for PVD and related vitreomacular interface abnormalities. It has been estimated that approximately 50% of individuals over 50 years and up to 65% of those over 65 years develop spontaneous PVD (5). The incomplete separation of the posterior hyaloid in some of these individuals leads to persistent adhesion at the macula, resulting in VMA. However, not all VMAs are clinically significant, and many do not require intervention unless progression to tractional states occurs.

Several studies have explored VMA prevalence in patients with diabetic retinopathy, age-related macular degeneration (AMD), and uveitis, where the adhesion may exacerbate disease progression or interfere with therapeutic response (6). However, in individuals without retinal pathology, understanding the baseline prevalence of VMA is essential for distinguishing age-related changes from disease-specific findings and guiding long-term monitoring strategies.

The current literature suggests variability in the detection of VMA depending on the population studied, OCT resolution, and diagnostic criteria. For instance, the Beaver Dam Eye Study and other population-based cohorts reported VMA prevalence ranging from 10% to 15% in older adults using OCT imaging, but these estimates often included individuals with systemic or ocular comorbidities (7). A focused assessment of VMA prevalence in individuals over 40 years without maculopathy would provide valuable insights into the natural history of the vitreomacular interface in aging eyes.

In this context, the present study was designed to determine the prevalence and demographic correlates of VMA in a cohort of asymptomatic individuals aged over 40 years without any clinical signs of maculopathy. By excluding subjects with diabetic retinopathy, AMD, or history of retinal surgery, the study aims to offer baseline data on age-related VMA in a healthy population, potentially aiding in the early detection of eyes at risk for future vitreomacular complications.

Methods

Study Design and Setting

This was a **cross-sectional observational study** conducted in the Department of Ophthalmology at a tertiary care center in South India from January to December 2023. The

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primary objective was to determine the prevalence of vitreomacular adhesion (VMA) in individuals aged over 40 years who had no clinical evidence of maculopathy.

Study Population

Participants included adults aged **≥40 years** who underwent routine ophthalmologic evaluation and were found to have normal macular anatomy on clinical fundus examination. Individuals were recruited consecutively from the outpatient ophthalmology department after obtaining informed consent.

Inclusion Criteria

- Age ≥40 years
- Clear ocular media allowing good-quality OCT imaging
- Absence of maculopathy on fundus examination
- No visual complaints suggestive of central vision loss

Exclusion Criteria

- History or clinical evidence of macular disease (e.g., macular hole, age-related macular degeneration, epiretinal membrane)
- Diabetic retinopathy or hypertensive retinopathy
- High myopia (>6 diopters)
- History of vitreoretinal surgery or laser therapy
- Presence of significant cataract impairing OCT quality

Ocular Examination and Imaging

All participants underwent a **comprehensive ophthalmic evaluation** including:

- Best corrected visual acuity (BCVA)
- Intraocular pressure measurement
- Slit-lamp biomicroscopy

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- Dilated fundus examination with +90D lens
- Spectral-domain optical coherence tomography (SD-OCT)

OCT was performed using the **Cirrus HD-OCT system (Carl Zeiss Meditec)**. A **5-line raster scan and macular cube scan** were obtained for each eye. The posterior vitreomacular interface was examined in detail.

Definition and Classification of VMA

VMA was defined based on **IVTS Group criteria** as:

- A perifoveal vitreous detachment with persistent adherence of the vitreous cortex to the macula
- Absence of foveal contour distortion, intraretinal cysts, or subretinal fluid

VMA was classified as:

- **Focal**: ≤1500 µm of vitreous attachment
- **Broad**: >1500 µm of vitreous attachment

Outcome Measures

- **Primary outcome**: Prevalence of VMA in eyes without maculopathy
- **Secondary outcomes**: Association of VMA with age, gender, and refractive status; characterization of VMA as unilateral or bilateral and focal or broad

Statistical Analysis

Data were analyzed using **SPSS version 26.0 (IBM Corp., Armonk, NY)**. Categorical variables were expressed as percentages and compared using **Chi-square or Fisher's exact test**. Continuous variables (e.g., age) were summarized as **mean ± standard deviation** and analyzed using **t-test or ANOVA** as appropriate. A **p-value <0.05** was considered statistically significant. The study was approved by the Institutional Ethics Committee. All participants provided written informed consent before enrolment. The study adhered to the tenets of the Declaration of Helsinki.

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Results

A total of **150 individuals (300 eyes)** were included in the study. The mean age was **57.3 ± 9.4 years**, with **52% females**. The overall **prevalence of VMA was 14.3% (43/300 eyes)**. Bilateral VMA was detected in **10 participants (6.7%)**. Most adhesions were **focal (81.4%)**, and all were asymptomatic.

Table 1: Demographic Profile of Study Population (n = 150 participants)

Parameter	Value
Mean age (years)	57.3 ± 9.4
Age group 40–49 yrs	41 (27.3%)
Age group 50–59 yrs	54 (36.0%)
Age group ≥60 yrs	55 (36.7%)
Gender (Male:Female)	72 (48%) : 78 (52%)
Mean spherical equivalent (D)	-0.21 ± 1.15

The study included 150 individuals (300 eyes) with a mean age of 57.3 ± 9.4 years. The majority of participants (72.7%) were aged 50 years or older, indicating a predominantly middle-aged to elderly cohort. Females constituted a slightly higher proportion of the study population (52%), and the mean spherical equivalent was −0.21 ± 1.15 D, indicating that most participants had emmetropia or mild refractive error.

Table 2: Prevalence of Vitreomacular Adhesion (VMA)

Category	Frequency (n)	Percentage (%)
Total eyes examined	300	100%
Eyes with VMA	43	14.3%

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Participants with bilateral VMA	10	6.7%

Of the 300 eyes examined, 43 (14.3%) showed evidence of VMA on spectral-domain OCT. Bilateral VMA was found in 10 participants (6.7%), while the majority had unilateral involvement. These findings demonstrate that VMA is relatively common in individuals without clinical maculopathy, even in the absence of visual symptoms.

Table 3: VMA Distribution by Age Group

Age Group (years)	Eyes with VMA (n)	Total Eyes (n)	Prevalence (%)	p-value
40–49	5	82	6.1%	
50–59	14	108	13.0%	
≥60	24	110	21.8%	0.01

The prevalence of VMA increased significantly with advancing age. While only 6.1% of eyes in the 40–49-year group had VMA, the rate rose to 13.0% in the 50–59-year group and peaked at 21.8% in individuals aged ≥60 years ($p = 0.01$). This age-dependent increase underscores the role of age-related vitreous degeneration in the development of vitreomacular interface abnormalities.

Table 4: Characteristics of VMA

Characteristic	Number (%)
Focal adhesion (≤1500 µm)	35 (81.4%)
Broad adhesion (>1500 µm)	8 (18.6%)
Unilateral VMA	33 (76.7%)
Bilateral VMA	10 (23.3%)
Associated symptoms	0 (all asymptomatic)

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Discussion

This study investigated the prevalence and characteristics of vitreomacular adhesion (VMA) in asymptomatic individuals aged over 40 years who showed no evidence of maculopathy on clinical examination. Our findings indicate that VMA is relatively common in this population, with an overall prevalence of **14.3%**, and a significantly higher prevalence of **21.8%** in those aged 60 years and above. The majority of adhesions were **focal** and **unilateral**, and all were **asymptomatic**, highlighting the often subclinical nature of VMA in aging eyes.

The age-related increase in VMA observed in this study supports the current understanding of posterior vitreous detachment (PVD) as an age-dependent degenerative event. As the vitreous body ages, it undergoes liquefaction (synchisis) and weakening of the vitreoretinal interface, which eventually leads to PVD. However, this process is not always complete, resulting in partial detachment and persistent vitreomacular adhesion. Previous studies have reported that complete PVD occurs in 50%–65% of people over the age of 60, and anomalous PVD may lead to persistent traction or adhesion at the macula (8).

The 14.3% prevalence of VMA in our cohort aligns with earlier population-based studies that reported VMA rates ranging from 10% to 15% in adults over 40 years (5). For example, the Beaver Dam Eye Study, one of the largest longitudinal population-based OCT studies, reported VMA in 13.6% of eyes with normal fundus findings (7). These findings emphasize that VMA is not uncommon in aging eyes, even in the absence of visual symptoms or overt maculopathy. Our data provide further evidence that VMA can be detected subclinically through high-resolution spectral-domain optical coherence tomography (SD-OCT).

In terms of morphology, **81.4%** of VMAs in our study were classified as **focal** (adhesion width ≤1500 μm), while **18.6%** were **broad** (>1500 μm). This is consistent with previous literature which has shown that focal VMA is more common and is less likely to progress to pathological sequelae compared to broad VMA (9). According to the International Vitreomacular Traction Study (IVTS) Group, broad adhesions are more likely to be associated with retinal distortion, epiretinal membrane formation, and eventual development of full-thickness macular holes (2). Although our study did not identify any symptoms or complications among the patients with VMA, the classification remains clinically important for predicting potential progression.

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The majority of VMA cases were **unilateral (76.7%)**, with **only 6.7%** of participants showing bilateral involvement. Previous studies have reported variable rates of bilateral VMA, and it is thought that the process of PVD occurs independently in each eye, with considerable inter-eye variability in timing and anatomical progression (6). The absence of symptoms in our cohort suggests that many VMAs remain stable and do not evolve into tractional states, especially when they are focal and in the absence of systemic or ocular comorbidities such as diabetes or uveitis.

While most cases of VMA do not require intervention, their detection becomes crucial when they are associated with progressive visual symptoms or when planning retinal procedures, such as intravitreal injections, which may disturb the vitreoretinal interface. Recent advances, including pharmacologic vitreolysis with agents like ocriplasmin, have opened new avenues for managing symptomatic VMAs and preventing complications such as macular holes or vitreomacular traction syndrome (3).

This study also adds to the growing body of evidence supporting the utility of OCT in screening and diagnosis of subtle retinal interface abnormalities. In routine practice, OCT is often reserved for symptomatic patients or those with diabetic or age-related macular changes. Our results suggest that periodic OCT screening in older adults—even in the absence of symptoms—can uncover early changes that may benefit from monitoring.

Despite its strengths, this study has some limitations. The cross-sectional nature of the design does not allow for assessment of the natural history or progression of VMA over time. Furthermore, the sample was hospital-based and may not reflect the general population. Exclusion of individuals with diabetes and other comorbidities, while necessary for isolating age-related changes, may have led to an underestimation of VMA prevalence in broader community settings.

Future studies should include longitudinal follow-up to track the progression of VMA and its transformation into more severe vitreomacular interface disorders. Incorporating data on vitreous status in relation to systemic diseases, axial length, and hormonal status may also enhance understanding of VMA pathogenesis.

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Conclusion

In conclusion, this study highlights that VMA is a relatively common subclinical finding in individuals over the age of 40, especially those above 60 years. Most VMAs are focal, unilateral, and asymptomatic, underscoring the importance of OCT in early detection and characterization. Understanding the prevalence and morphology of VMA in healthy individuals may guide better risk assessment and surveillance strategies for vitreoretinal interface disorders in the aging population.

Recommendations

Given the relatively high prevalence of asymptomatic vitreomacular adhesions (VMA) in individuals over 40 years—especially those aged ≥60 years—it is recommended that **routine OCT screening** be considered in this population during comprehensive eye exams, even in the absence of visual complaints. Clinicians should document and monitor VMAs, particularly broad adhesions, as these may predispose to future vitreomacular traction or macular holes. Educating patients about subtle symptoms of visual distortion and encouraging regular follow-up can aid in early detection of progression. Further longitudinal research is advised to determine which asymptomatic VMAs are at highest risk of evolving into clinically significant macular disease.

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