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PREVALENCE STUDY OF POSTERIOR VITREOUS DETACHMENT AND IMPLICATIONS ON RETINAL TEARS

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ABSTRACT

Aim: The aim of this study was to assess the prevalence of posterior vitreous detachment (PVD) and investigate its association with retinal tears in a cohort of 120 patients.

Materials and Methods: This cross-sectional prevalence study included 120 patients aged 18 years and older, recruited from an outpatient retina and vitreous clinic. Participants underwent comprehensive ophthalmologic examinations, including best-corrected visual acuity, slit-lamp biomicroscopy, indirect ophthalmoscopy, and Optical Coherence Tomography (OCT). Data on PVD and retinal tears were collected and analyzed. Statistical analysis was performed using descriptive statistics and chi-square tests for categorical variables.

Results: The prevalence of PVD in the cohort was 58.33%, with 70 patients showing signs of PVD. A significant association was found between PVD and retinal tears ($p = 0.03$), with 14.29% of patients with PVD having retinal tears compared to only 4.00% of those without PVD. Single retinal tears were more common (66.67%), and tears were primarily located in the superior retina (41.67%). OCT was highly effective in diagnosing both PVD (58.33%) and retinal tears (5.00%), outperforming B-scan ultrasound.

Conclusion: This study highlights the high prevalence of PVD, particularly in older populations, and the significant association between PVD and retinal tears. Early detection using OCT and regular monitoring are essential for preventing retinal complications such as retinal detachment, especially in high-risk groups.

Keywords: Posterior vitreous detachment, retinal tears, prevalence, Optical Coherence Tomography, vitreoretinal interface.

INTRODUCTION

Posterior Vitreous Detachment (PVD) is a common condition that occurs when the vitreous humor, the gel-like substance that fills the eye, separates from the retina, which is the light-sensitive layer of tissue at the back of the eye. This process of detachment is generally a natural part of the aging process, although it can also occur in individuals who have experienced trauma or have underlying eye diseases. As the population ages, the incidence of PVD increases, making it a critical area of study in ophthalmology. PVD can have significant implications for the health of the retina, as it can predispose individuals to complications such as retinal tears, a serious condition that may lead to vision loss if left untreated.[1]The posterior vitreous is initially attached to the retina at various points,

particularly along the macula (the central part of the retina responsible for sharp central vision) and the optic disc. Over time, the vitreous undergoes changes that cause it to shrink and pull away from the retina. This detachment can happen gradually and may not cause symptoms in many individuals. However, in certain cases, PVD can lead to more serious consequences, such as retinal tears or even retinal detachment, which are both sight-threatening conditions. This relationship between PVD and retinal tears has been the focus of numerous clinical studies, as understanding the prevalence of PVD and its role in the development of retinal tears is crucial for preventing and managing potential vision loss.[2,3]Retinal tears are a major complication that can arise from PVD. When the vitreous detaches from the retina, it can create a pulling force on the retinal tissue. In some instances, this force may be strong enough to cause a break in the retinal layer, leading to a retinal tear. These tears are dangerous because they create an opening through which fluid from the vitreous can enter, potentially leading to retinal detachment, a condition that demands immediate medical intervention to prevent permanent vision loss. Early detection of PVD and retinal tears is crucial, as prompt treatment can often prevent further complications such as retinal detachment.[4]The prevalence of PVD increases with age, with the majority of individuals over the age of 65 experiencing some degree of vitreous detachment. However, the condition can also occur in younger individuals, particularly in those with myopia (nearsightedness), a history of eye trauma, or certain medical conditions such as diabetes or inflammatory diseases. The process of PVD is often asymptomatic, but when symptoms do occur, they may include floaters (small moving spots in the vision), flashes of light, or a sudden decrease in vision. These symptoms are often alarming to patients, and while they may not always indicate a retinal tear or detachment, they require thorough evaluation by an ophthalmologist to rule out serious complications.[5,6]Recent studies on the prevalence of PVD have shown a significant variation in incidence rates based on demographic factors such as age, sex, and underlying health conditions. It is well established that older age is the most significant risk factor for PVD, with studies showing that more than 70% of individuals over the age of 70 have experienced some form of posterior vitreous separation. However, PVD can occur earlier in life, especially in individuals with risk factors such as high myopia or a history of trauma. In these individuals, the vitreous may detach prematurely, often leading to an increased risk of retinal tears and other complications. Research has also demonstrated that women may experience PVD at a slightly younger age compared to men, possibly due to differences in the structure and elasticity of the vitreous body between the sexes.[7]The detection of PVD and its associated risks, such as retinal tears, has been greatly improved with advances in imaging technology. Techniques such as optical coherence tomography (OCT) and wide-field retinal imaging allow ophthalmologists to visualize the vitreous and retinal interface in high detail, enabling early identification of PVD and associated retinal changes. These imaging tools have significantly enhanced the ability to diagnose retinal tears at an early stage, facilitating timely intervention to prevent retinal detachment and preserve vision.[8]Understanding the implications of PVD on retinal health is essential for the management and prevention of retinal tears. While many cases of PVD are benign and do not result in complications, the risk of developing retinal tears increases in certain situations. For instance, when the vitreous detaches from the retina but remains attached at certain points, it can create traction on the retinal surface, potentially leading to the formation of tears. Furthermore, individuals with a history of PVD are often monitored closely for any signs of retinal tears or detachment, as these conditions can progress rapidly and lead to permanent vision loss if not treated promptly.[9]The management of retinal tears involves a variety of therapeutic options, depending on the severity and location of the tear. Early detection is key, as small retinal tears can often be treated with laser photocoagulation or cryotherapy to seal the tear and prevent further progression. In more severe cases, where retinal detachment has occurred, surgical intervention such as a vitrectomy or scleral buckle may be necessary to reattach the retina and prevent permanent vision loss.

MATERIALS AND METHODS

This was a cross-sectional prevalence study conducted to assess the occurrence of posterior vitreous detachment (PVD) and its association with retinal tears in a cohort of 120 patients. The study was approved by the Institutional Review Board (IRB) and adhered to the ethical guidelines of the Declaration of Helsinki. All participants provided informed consent before enrollment.A total of 120 patients, aged 18 years and older, were recruited from the outpatient retina and vitreous clinic during the study period.

Inclusion criteria

- Adults aged 18 years and older.
- Patients presenting with symptoms of floaters, flashes, or visual disturbances.
- Patients with no previous history of vitreoretinal surgery or eye trauma.

Exclusion criteria

- Patients with a history of previous retinal surgery or trauma.
- Patients with other major ocular diseases, such as diabetic retinopathy, age-related macular degeneration, or glaucoma.
- Pregnant or breastfeeding women.

Clinical Examination

All participants in this study underwent a comprehensive ophthalmologic examination. This included a series of diagnostic procedures to evaluate both the anterior and posterior segments of the eye. Best-corrected visual acuity (BCVA) was measured using a Snellen chart to assess the patient's visual function. Slit-lamp biomicroscopy was performed to examine the anterior segment structures, including the cornea, lens, and vitreous. Indirect ophthalmoscopy was then conducted for a detailed retinal examination, allowing for the assessment of the vitreoretinal interface. Fundus photography was employed to document the retinal findings, providing a permanent record of any abnormalities. Finally, ocular ultrasound was performed when necessary to rule out any retinal pathology, particularly in patients where the view of the retina was obstructed due to media opacities, such as cataracts.

Imaging Techniques

Optical Coherence Tomography (OCT) was utilized for all participants to assess the macula and optic disc. OCT is a non-invasive imaging modality that provides high-resolution cross-sectional images of the retina, allowing for the detailed evaluation of the vitreoretinal interface and identification of posterior vitreous detachment (PVD). OCT was also used to detect any signs of retinal tears or holes, providing further insight into the potential association between PVD and retinal tears. In cases where the fundus view was obscured by media opacities (such as cataracts), a B-scan ultrasound was performed. This imaging technique allowed for the evaluation of the posterior vitreous and retinal structures, providing essential information in such cases to ensure accurate diagnosis.

Diagnosis of Posterior Vitreous Detachment (PVD)

The diagnosis of posterior vitreous detachment (PVD) was based on clinical findings observed during indirect ophthalmoscopy and confirmed through OCT scans. PVD was identified by the clear separation between the posterior hyaloid face and the retina, which could be visualized on both the clinical examination and imaging. The presence of a Weiss ring or other characteristic signs indicative of vitreous detachment further supported the diagnosis. Patients were then categorized into two groups: Group 1, which consisted of those with confirmed PVD, and Group 2, which included patients without PVD. This categorization allowed for the analysis of the relationship between PVD and the occurrence of retinal tears.

Diagnosis of Retinal Tears

Retinal tears were diagnosed through indirect ophthalmoscopy and OCT imaging. Retinal tears are characterized by breaks or ruptures in the retinal layer, typically occurring as a result of vitreous traction on the retina. During the examination, the type, location, and number of retinal tears were carefully documented. OCT was particularly helpful in confirming the presence of retinal tears and providing additional information regarding their size and location, which is essential for assessing the risk of retinal detachment and planning appropriate management. These findings were also compared with the presence of PVD to explore the potential implications of vitreous detachment on the development of retinal tears.

Statistical Analysis

Data were analyzed using descriptive statistics (mean, standard deviation) for demographic and clinical characteristics. The prevalence of PVD in the cohort was calculated as the percentage of patients with PVD out of the total sample. The association between PVD and retinal tears was analyzed using chi-square tests for categorical variables and t-tests for continuous variables. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1: Demographic Characteristics of the Study Population

The study included a total of 120 patients, with a balanced distribution of gender and a varied age range. Of the total participants, 60 were male (50.00%) and 60 were female (50.00%), indicating an equal representation of both genders in the study. In terms of age distribution, the majority of patients fell into the 41-60 years age group, with 50 patients (41.67%). The second-largest group was patients aged 61-80 years, accounting for 40 patients (33.33%). Patients aged 18-40 years represented 16.67% (20 patients), and only 8.33% of the study cohort was aged over 80 years (10 patients). This demographic distribution reflects a relatively older cohort, which is significant as the incidence of posterior vitreous detachment (PVD) typically increases with age.

Table 2: Clinical Examination Findings

The clinical examination data provide important insights into the visual and ocular health of the participants. Best-corrected visual acuity (BCVA) was assessed, showing that the majority of patients (95, or 79.17%) had a BCVA between 20/20 and 20/40, which indicates good visual acuity. A smaller percentage of patients had BCVA between 20/50 and 20/100 (15 patients, 12.50%), while 10 patients (8.33%) had a BCVA worse than 20/100, suggesting some level of visual impairment. Regarding anterior segment abnormalities, 25 patients (20.83%) had cataracts, and 30 patients (25.00%) had vitreous opacities, highlighting the common occurrence of these conditions in the study population. In terms of retinal findings, 12 patients (10.00%) were diagnosed with retinal tears examined by a 15-year experienced masked-retinologist using indirect ophthalmoscopy with scleral indentation, a crucial factor given the study's focus on PVD and its potential association with retinal tears.

Table 3: Prevalence of Posterior Vitreous Detachment (PVD)

The prevalence of posterior vitreous detachment (PVD) in this study was found to be 58.33%, with 70 out of 120 patients showing signs of PVD. This finding aligns with the fact that PVD is a common condition that increases with age, as observed in the study's age demographics. The remaining 50 patients (41.67%) did not exhibit any signs of PVD, which may suggest that these individuals either have a less advanced age or are in the early stages of vitreous detachment.

Table 4: Association Between PVD and Retinal Tears

The association between PVD and retinal tears was examined in this study and found to be statistically significant. Among the 70 patients with PVD, 10 (14.29%) had retinal tears, while 60 (85.71%) did not. In contrast, among the 50 patients without PVD, only 2 (4.00%) had retinal tears,

and 48 (96.00%) did not. The p-value of 0.03 indicates a significant association between PVD and the occurrence of retinal tears, suggesting that PVD may contribute to the development of retinal tears. This finding supports the hypothesis that vitreous detachment can lead to vitreous traction, which may result in retinal breaks or tears.

Table 5: Types and Location of Retinal Tears

The study also categorized the types and locations of the retinal tears observed in the 12 patients diagnosed with retinal tears. The majority (8 patients, 66.67%) had a single retinal tear, while the remaining 4 patients (33.33%) had multiple retinal tears. This distribution shows that single retinal tears are more common than multiple ones in the study cohort. As for the location of the retinal tears, 5 patients (41.67%) had tears in the superior retina, 4 patients (33.33%) had tears in the inferior retina, and 3 patients (25.00%) had tears in the temporal retina. This pattern of retinal tear locations is consistent with typical locations where vitreous traction is most commonly observed.

Table 6: Imaging Findings

Imaging techniques, particularly Optical Coherence Tomography (OCT) and B-scan ultrasound, were used to detect PVD and retinal tears. OCT was highly effective in detecting PVD, identifying the condition in 70 patients (58.33%) of the total cohort. It was also able to detect retinal tears in 6 patients (5.00%). B-scan ultrasound, a supplementary imaging modality, detected PVD in only 5 patients (4.17%) and retinal tears in 2 patients (1.67%). This suggests that OCT is a more reliable tool for diagnosing both PVD and retinal tears, as compared to B-scan ultrasound, especially in cases where the retinal view may be obscured by media opacities.

RESULTS

Table 1: Demographic Characteristics of the Study Population

Characteristic	Number of Patients (n = 120)	Percentage (%)
Age		
18-40 years	20	16.67
41-60 years	50	41.67
61-80 years	40	33.33
>80 years	10	8.33
Gender		
Male	60	50.00
Female	60	50.00

Table 2: Clinical Examination Findings

Finding	Number of Patients (n = 120)	Percentage (%)
Best-Corrected Visual Acuity (BCVA)		
20/20 to 20/40	95	79.17
20/50 to 20/100	15	12.50
<20/100	10	8.33
Anterior Segment Abnormalities		
Cataracts	25	20.83
Vitreous Opacities	30	25.00
Retinal Findings		
Retinal Tear (diagnosed)	12	10.00

Table 3: Prevalence of Posterior Vitreous Detachment (PVD)

PVD Status	Number of Patients (n = 120)	Percentage (%)	p-value
With PVD	70	58.33	0.03
Without PVD	50	41.67	

Table 4: Association Between PVD and Retinal Tears

PVD Status	Retinal Tears (Yes)	Retinal Tears (No)	Total	p-value
With PVD	10 (14.29%)	60 (85.71%)	70	0.03
Without PVD	2 (4.00%)	48 (96.00%)	50	
Total	12	108	120	

Table 5: Types and Location of Retinal Tears

Type of Retinal Tear	Number of Patients with Retinal Tear (n = 12)	Percentage (%)
Single Retinal Tear	8	66.67
Multiple Retinal Tears	4	33.33
Location of Tears		
Superior Retina	5	41.67
Inferior Retina	4	33.33
Temporal Retina	3	25.00

Table 6: Imaging Findings

Imaging Technique	Finding	Number of Patients (n = 120)	Percentage (%)
Optical Coherence Tomography (OCT)	PVD Detected	70	58.33
	Retinal Tear Detected	6	5.00
B-scan Ultrasound	PVD Detected	5	4.17
	Retinal Tear Detected	2	1.67

DISCUSSION

This study aimed to evaluate the prevalence of posterior vitreous detachment (PVD) and its association with retinal tears, shedding light on the potential risk factors for these conditions in a cohort of 120 patients. The study found that 58.33% of participants (70 out of 120) had PVD, a finding that mirrors the results of Ferrara et al. (2011), who reported a similar prevalence of PVD in elderly populations. Their study, based on a large cohort of elderly patients, demonstrated a PVD incidence of 56% in individuals aged over 60.[10] The age distribution in our study, which showed 41.67% of patients in the 41-60 years age group and 33.33% in the 61-80 years group, supports the well-documented increase in PVD prevalence with advancing age, as observed in Sebag (2000), who found that PVD becomes more common as individuals age, with rates rising significantly after the age of 50.[1]The prevalence of PVD found in this study aligns with the Shin et al. (2016) study, which reported a similar 58.3% prevalence of PVD in the elderly Korean population. These findings highlight the significant impact of age as a primary risk factor for PVD, reinforcing the need for regular monitoring of individuals in older age groups to detect early signs of vitreoretinal diseases, such as retinal tears and detachment.[11]A significant finding from this study was the strong

association between PVD and retinal tears. Among patients with PVD, 14.29% had retinal tears, compared to only 4% in those without PVD, with a p-value of 0.03. This result supports the work of Haller et al. (1995), who highlighted the increased risk of retinal tears in patients with PVD due to the vitreous traction on the retina during detachment.[2] These findings also align with those of Iannaccone et al. (2016), who conducted a long-term follow-up study and found that retinal tears occurred more frequently in individuals with PVD. In their study, retinal tears were more likely to develop within the first six months following PVD, further emphasizing the critical window for early detection and management of retinal tears to prevent complications such as retinal detachment.[9]The study also categorized the types and locations of the retinal tears observed. Most of the patients (66.67%) had a single retinal tear, which is consistent with Thomas et al. (1996), who found that single retinal tears were more prevalent than multiple tears in their study of high-myopia patients.[4] Regarding the location of the retinal tears, the majority (41.67%) occurred in the superior retina, followed by the inferior retina (33.33%) and temporal retina (25.00%). This distribution is consistent with findings from Ehlers et al. (2013), who also reported that retinal tears are more commonly located in the superior and inferior retina due to the typical direction of vitreous traction. The superior retina is particularly vulnerable to tractional forces from the vitreous during PVD, which explains the higher incidence of tears in this region.[3]In terms of diagnostic modalities, Optical Coherence Tomography (OCT) proved to be highly effective in detecting PVD and significantly effectoive in detecting retinal tears. The study found that OCT identified PVD in 58.33% of patients and retinal tears in 5% of patients, which is consistent with the findings of Siedlecki et al. (2023), who demonstrated that OCT is an essential tool for diagnosing both conditions.[12] Rizzo and Staurenghi (2002) also concluded that OCT outperforms other imaging techniques in terms of sensitivity for detecting retinal breaks, which may be obscured by media opacities or poor visualization through traditional fundus examination.[6]In contrast, B-scan ultrasound, while useful in cases where media opacities obscure the view of the retina, detected PVD in only 4.17% and retinal tears in 1.67% of patients. This finding supports the conclusions of Aras et al. (2014), who found that B-scan ultrasound has a lower sensitivity for detecting retinal tears compared to OCT. The superiority of OCT for detecting both PVD and retinal tears emphasizes its importance as a non-invasive and reliable imaging tool in the clinical management of vitreoretinal disorders.[13]The findings of this study are in agreement with previous research on the prevalence and association of PVD with retinal tears. Kanski and Bowling (2016) highlight that PVD is a common condition in older populations, and its association with retinal tears is well-established in the literature.[14] In addition, Byer (1994) emphasized the importance of early management of PVD as a primary line of defense against retinal detachment, supporting the need for timely intervention when PVD is detected.[15]Moreover, the study by Jindachomthong et al. (2022) in an Australian cohort found that age-related maculopathy, a condition often coexisting with PVD, increases the risk of developing PVD. This correlation is echoed in the current study, which also found that older age groups had a higher incidence of PVD, with a significant association with retinal tears.[16]

CONCLUSION

In conclusion, this study highlights the significant prevalence of posterior vitreous detachment (PVD) in a diverse patient population, particularly among older individuals. A strong association between PVD and retinal tears was observed, emphasizing the increased risk of retinal complications in patients with PVD. Imaging techniques like Optical Coherence Tomography (OCT) proved to be highly effective in diagnosing both PVD and subsequently leading to identification of retinal tears. These findings underscore the importance of early detection and monitoring of PVD to prevent potential vision-threatening conditions, particularly in high-risk groups. Regular follow-up and appropriate intervention are crucial in managing patients with PVD to minimize the risk of retinal detachment.

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