Symptomatic Posterior Vitreous Detachment and the Incidence of Delayed Retinal Breaks: Case Series and Meta-analysis

ROBERT E. COFFEE, ANDREW C. WESTFALL, GARVIN H. DAVIS, WILLIAM F. MIELER, AND ERIC R. HOLZ

• PURPOSE: **To establish the necessity for an early follow-up examination after an initial funduscopic examination with negative results for patients with acute, symptomatic posterior vitreous detachment (PVD).**

• DESIGN: **Retrospective case-control study and meta-analysis.**

• METHODS: **Records were reviewed of patients seeking treatment over a 4.5-year period who were diagnosed with an acute, symptomatic PVD. A MEDLINE search to identify all published observational case studies reporting vitreoretinal pathologic features after acute, symptomatic PVD.**

• RESULTS: **The incidence of retinal tears in eyes with a symptomatic PVD was 8.2%. The overall rate of retinal break in the meta-analysis portion of the study was 21.7%. In total, 1.8% of patients had retinal tears that were not seen on initial examination. Of the 29 patients with delayed-onset retinal breaks, 24 (82.8%) had at least one of the following: vitreous hemorrhage at initial examination, hemorrhage in the peripheral retina at initial examination, or new symptoms.**

• CONCLUSIONS: **If the results of an initial examination of a patient with an acute, symptomatic PVD are negative for retinal tears, the necessity of early follow-up may be best determined by the presence of pigmented cells in the vitreous, vitreous hemorrhage, or retinal hemorrhage. Most patients with symptomatic PVD may not need an early follow-up examination. (Am J Ophthalmol 2007;144: 409–413. © 2007 by Elsevier Inc. All rights reserved.)**

THE MOST COMMON CAUSE OF RETINAL TEARS IS separation of the posterior vitreous (posterior hyaloid face) from the retinal surface. Most retinal tears occur at the posterior aspect of the vitreous base, which is a circumferential zone extending approximately 2 mm anterior to the ora serrata and 4 mm posterior to the ora serrata, where vitreous attachments may exert significant traction on the retina. Vitreous separation can cause visual symptoms such as photopsias resulting from vitreous–retina traction and floaters resulting from the presence of condensed vitreous collagen, blood, or pigment. When these visual symptoms accompany the separation of the vitreous from the retina, it is referred to as a symptomatic, acute posterior vitreous detachment (PVD).[1–5]

Discovery of retinal tears is important when attempting to prevent retinal detachments.[2–4] Approximately one-half of eyes with a symptomatic retinal tear and persistent vitreoretinal traction will progress to retinal detachment without treatment.[6–8] Risk factors for a retinal tear with a symptomatic PVD include hemorrhage or retinal pigment epithelial cells in the anterior vitreous. Additional reported risk factors for a retinal tear are myopia, trauma, pseudophakia, aphakia, lattice degeneration, retinal detachment in the fellow eye, and a positive family history of retinal detachment.[4,9–16]

The standard for locating retinal tears in the setting of a symptomatic PVD is a comprehensive eye evaluation including confrontation visual fields, slit-lamp biomicroscopy of the anterior and posterior vitreous along with the macula, peripheral fundus examination, frequently with scleral depression and B-scan ultrasonography, if unable, to visualize the fundus.[1–4,17–21] Even if the initial vitreoretinal examination results are normal, there may be a small chance of a retinal tear occurring in the ensuing weeks.[4] This study was undertaken to evaluate the incidence of retinal tears discovered on follow-up examination and to identify key findings that put patients at higher risk. This information may be helpful for ophthalmologists when attempting to balance the need to identify possible vision-threatening sequelae of a PVD with the time and resources that must be devoted to follow-up examinations.

METHODS

• RETROSPECTIVE CASE-CONTROL STUDY: The medical records were reviewed for all patients diagnosed with an acute symptomatic PVD in the Retina Section of the Department of Ophthalmology, Baylor College of Medicine between January 1, 1999 and July 31, 2003. An acute symptomatic PVD was defined as the new onset of symptoms (flashes and floaters) within one month of presentation and

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From the Cullen Eye Institute, Baylor College of Medicine, Houston, Texas.

Inquiries to Eric R. Holz, Cullen Eye Institute, Baylor College of Medicine, 6565 Fannin, NC 205, Houston, TX 77030; e-mail: eholz@bcm.tmc.edu

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TABLE. Incidence of Retinal Pathologic Features among Patients with Acute, Symptomatic Posterior Vitreous Detachment

Study (yr)	No. Patients with Symptomatic PVD	Total No. Retinal Breaks	No. Delayed Retinal Breaks	No. Hemorrhages or New Symptoms	No. Unexplained Delayed Retinal Breaks
Linder[27] (1966)	106	16	0	0	0
Tasman[3] (1968)	93	11	3	2	1
Jaffe[22] (1968)	84	9	1	1	0
Kanski[23] (1975)	150	69	3	3	0
Tabotabo and associates[26] (1980)	100	12	2	2	0
Novak and Welch[24] (1984)	172	14	2	2	0
Byer[5] (1994)	350	50	8	8	0
Dayan and associates[4] (1996)	295	90	6	3	3
Richardson and associates[25] (1999)	105	11	2	2	0
Coffee (2007)	219	18	2	1	1
Total	1568	300	29	24	5

PVD = posterior vitreous detachment.

the presence of a Weiss ring on examination of the posterior vitreous. Patients with previous retinal detachments resulting from other ocular pathologic features, direct ocular trauma, or previous vitreoretinal surgery were excluded. All examinations were performed by one of two vitreoretinal specialists (E.R.H. or W.F.M.), each with at least 10 years of experience in performing retinal examinations. Their standard examination included visual acuity, confrontation visual fields, pupils, extraocular movement, intraocular pressure measurement, anterior segment examination, and dilated fundus examination using a slit-lamp biomicroscope and indirect ophthalmoscope.

Retinal breaks were categorized as horseshoe tears, operculated holes, or atrophic holes. Treatment was categorized as laser, cryotherapy, or both. Because of the difficulty in differentiating red blood cells from retinal pigment epithelial cells in the anterior vitreous, both of these were defined as pigmented cells.

The management for each patient was determined by one of the two vitreoretinal specialists described above. All patients were educated on the warning signs for a retinal detachment, including new or increasing frequency of their flashes or floaters and visual field deficits. Patients were advised to undergo follow-up examinations based on the opinion of the retinal specialist. The principal outcome measure was the presence of a retinal tear on the initial examination or follow-up examination.

• **META-ANALYSIS:** A MEDLINE literature search was performed to identify observational studies reporting on the follow-up of patients with acute, symptomatic PVD. Only studies reporting patient history and symptoms, along with long-term follow-up of at least one month, were used in the meta-analysis of determining risk factors for delayed retinal breaks. In total, 251 MEDLINE articles were found by searching for vitreous detachment with the search limits of English language and human subjects. Of the 251 articles, 208 were excluded because they were case reports (11 articles), letters (six articles), nonclinical (45 articles), surgical (14 articles), or unrelated to the topic (127 articles), leaving 43 articles to review. An additional five articles were discovered after reference review, increasing the total articles reviewed to 48. Of the 48 studies that were reviewed, 39 were eliminated for not reporting symptoms or the lack of follow-up data, resulting in nine published studies.[3–5,22–27] We added currently unpublished data from our own institution. Of the 10 studies, six studies were prospective, three studies were retrospective, and one included combined prospective and retrospective data. Data from the first part of this research were included as one of the 10 studies to be analyzed.

Data abstracted from reviewed studies included the incidence of retinal tears at the time of first examination for an acute, symptomatic posterior vitreous detachment and the incidence rate of retinal tears discovered on follow-up examination (Table). The characteristics of those patients with delayed retinal breaks were reviewed. The odds ratio (OR) and 95% confidence interval (CI) for the association between retinal breaks and any of three risk factors (new symptoms, pigmented cells present in the vitreous, or aphakia) were calculated for each study and for all the studies combined using a random effects model.

RESULTS

• **RETROSPECTIVE CASE-CONTROL STUDY:** The study included 219 patients with a median age of 62 years (range, 44 to 92 years). Approximately 28% of the study patients had undergone previous ocular surgery that was not part of the exclusion criteria. Of all study patients, 17.8% had undergone cataract surgery but none of them had been left aphakic. Anterior vitreous cells were seen in approximately 12% of patients. Regarding bleeding complications, retinal hemorrhage alone was noted in

6.9% of patients and vitreous hemorrhage alone was noted in 5.5% of patients. Both retinal and vitreous hemorrhages were observed in 1.4% of study patients. The prevalence of lattice degeneration was 6.4%. Overall, 18 (8.2%) of the 219 study patients with an acute symptomatic PVD were discovered to have a retinal break. These results are summarized in the Table.

Of the remaining 201 patients without a retinal break, 136 follow-up examinations were performed within four weeks of the initial visit. Five patients did not return for a recommended follow-up examination, whereas the other 60 patients were not advised to undergo a second examination. At the follow-up examination, two (1.5%) of 136 patients were found to have late retinal breaks. One of these cases with a horseshoe tear at presentation had a history of minor trauma (hit by basketball on the head), vitreous hemorrhage, lattice degeneration, and moderate myopia (−4.00 diopters [D]). The second patient experienced a horseshoe tear three months later and had moderate myopia (−6.00 D). No patients in this part of the study experienced a retinal detachment.

• **META-ANALYSIS:** Overall, 1,568 patients with acute, symptomatic PVD were analyzed with an initial retinal tear rate of 21.7%. This rate varied from 47.6% to 8.2%. Microscopic pigmented vitreous cells, frank vitreous hemorrhage, or hemorrhage in the retina were associated with initial retinal breaks (OR, 9.3; 95% CI, 6.6 to 13).

In total, 29 patients were reported to have retinal breaks on follow-up examination that were not seen on initial examination. Of the original 1,568 patients, the delayed retinal tear rate was 1.8% (range, 0.9% to 3.2%). Of the 29 patients with delayed-onset retinal breaks, 24 had at least one of the following: new symptoms, hemorrhage in the peripheral retina, or hemorrhage in the vitreous. When considering all patients with symptomatic PVD, the odds of a delayed retinal break were significantly greater in patients with any of these signs or symptoms (OR, 15.6; 95% CI, 7.1 to 34.5).

DISCUSSION

IN THE MEDICAL RECORD REVIEW FROM A SINGLE CENTER, the rate of retinal tears after an acute, symptomatic PVD was relatively low (8.2%). In contrast, the meta-analysis of published reports, which included these data, showed that retinal breaks or tears were relatively common after a symptomatic PVD (21.7%), but there was wide variability in the reported incidence of retinal breaks between the different studies (47.6% to 8.2%). This is likely because of the differences in referral patterns and the availability of vitreoretinal specialists among study locations.

The rate of retinal tears after acute PVD in our case series may be small because patients did not return to our clinic after having new symptoms or a new event. However, the average total follow-up time for the 136 patients who were recommended to return was approximately 1.6 years, which was well within the range of follow-up for the other studies in the meta-analysis.

Of the follow-up examinations performed in the medical record review in the review of our center, only two (1.5%) of 136 patients were found to have late-stage retinal breaks. One of these patients did not have vitreous cells, hemorrhage, aphakia, or new symptoms. However, this patient had moderate myopia (−6.00 D). Similarly, in the meta-analysis portion of this research, the estimated rate of delayed retinal breaks was low (1.8%), despite taking all patients as an equal cohort. This suggests that the incidence of delayed retinal breaks after an acute symptomatic PVD is low.

When considering patients from the review of the literature who had delayed retinal breaks, almost all of them are described as having pigmented cells in the vitreous, a frank vitreous hemorrhage, hemorrhage in the retina itself, or new symptoms that prompted a return visit for examination. Only five of 1,568 patients did not have one of these characteristics. Tasman described one patient who had been treated with cryotherapy in one eye for a symptomatic PVD and horseshoe tear and who sought treatment five months later for symptoms concerning the previously uninvolved eye.[3] At the time of the follow-up examination, a PVD and two horseshoe tears were found in the symptomatic eye and several asymptomatic round holes were discovered in the previously treated eye. Dayan and associates also described three retinal breaks found at follow-up examination that were not seen at initial examination in which the patient had no large hemorrhage or new symptoms, two of which were round holes and one of which was a horseshoe tear.[4] However, Dayan and associates did not specifically note the presence of pigmented cells in the anterior vitreous on slit-lamp examination or retinal hemorrhages. Richardson and associates described two patients with delayed breaks that were round holes, both of whom had vitreous hemorrhages at initial examination.[25] None of the other authors specifically describe the characteristics of the delayed retinal breaks. Also, other than the patient described by Tasman, none of the authors reported delayed retinal breaks occurring in previously treated eyes.

Studies also have shown that there is a small risk for a retinal tear to occur two to six weeks after the initial examination. Therefore, the current recommendation is to perform a subsequent examination four to six weeks later.[4,22] Of the patients with delayed retinal breaks found in the literature, almost all of them were seen within two months of the initial examination. However, some of the authors are a bit vague about when these delayed breaks actually were found.[3,4,23] Kanski described a patient in whom a delayed retinal break was found more than one year after the initial examination, but this patient had a vitreous hemorrhage.[23] Tabotabo and associates described a patient who sought treatment six months later, but this

patient also had blood in the vitreous on examination.[26] Byer described the most delayed retinal breaks and reported six patients who sought treatment between seven months and 10 years after the initial examination.[5] All of these patients described by Byer are listed as seeking treatment with new symptoms.

The retrospective design of some of the studies included in the meta-analysis is a limitation of this research, because it is difficult to determine quality of examinations and data recording retrospectively. Because of the varying clinical characteristics recorded by different investigators, it was not possible to construct a multivariate model of the risk of retinal break after PVD. A prospective, multicenter trial of acute posterior symptomatic vitreous detachment with long-term follow-up would overcome data collection and analysis limitations.

By assessing patient risk factors, the population at higher risk for delayed retinal breaks can be discovered. The cohort with pigmented vitreous cells, hemorrhage in the retina or vitreous, new symptoms, lattice degeneration, or high myopia represent a higher risk group for retinal tears and detachments and may warrant routine follow-up examinations at two to six weeks in an attempt to discover retinal pathologic features amenable to prophylactic treatment. Patients without these risk factors may need only to be educated on importance of recognizing the symptoms of a retinal detachment and seeking appropriate medical attention when necessary.

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REPORTING VISUAL ACUITIES

The AJO encourages authors to report the visual acuity in the manuscript using the same nomenclature that was used in gathering the data provided they were recorded in one of the methods listed here. This table of equivalent visual acuities is provided to the readers as an aid to interpret visual acuity findings in familiar units.

Table of Equivalent Visual Acuity Measurements

Snellen Visual Acuities				
4 Meters	6 Meters	20 Feet	Decimal Fraction	LogMAR
4/40	6/60	20/200	0.10	+1.0
4/32	6/48	20/160	0.125	+0.9
4/25	6/38	20/125	0.16	+0.8
4/20	6/30	20/100	0.20	+0.7
4/16	6/24	20/80	0.25	+0.6
4/12.6	6/20	20/63	0.32	+0.5
4/10	6/15	20/50	0.40	+0.4
4/8	6/12	20/40	0.50	+0.3
4/6.3	6/10	20/32	0.63	+0.2
4/5	6/7.5	20/25	0.80	+0.1
4/4	6/6	20/20	1.00	0.0
4/3.2	6/5	20/16	1.25	−0.1
4/2.5	6/3.75	20/12.5	1.60	−0.2
4/2	6/3	20/10	2.00	−0.3

From Ferris FL III, Kassoff A, Bresnick GH, Bailey I. New visual acuity charts for clinical research. Am J Ophthalmol 1982;94:91–96.

Biosketch

Eric R. Holz, MD, is an Associate Professor at Baylor College of Medicine, Houston, Texas. Dr Holz graduated from Baylor College of Medicine and did his residency there as well. He completed his fellowship specializing in vitreoretinal diseases and surgery with The University of Oklahoma, Dean A. McGee Eye Institute, Oklahoma City, Oklahoma.