Acute posterior vitreous detachment: the predictive value of vitreous pigment and symptomatology

Vaughan Tanner, Deacon Harle, James Tan, Barney Foote, Thomas H Williamson, Anthony H Chignell

Abstract
Aim—To establish whether the presence of a retinal break can be predicted either by the presence of a positive Shafer’s sign (pigment granules in the anterior vitreous) or symptomatology in patients presenting with an acute posterior vitreous detachment (PVD).

Methods—200 eyes of 200 phakic patients with a symptomatic PVD of less than 1 month’s duration underwent documentation of symptomatology and examination of the anterior vitreous for the presence of pigment granules. Indentation ophthalmoscopy was then carried out by an experienced vitreoretinal surgeon with no knowledge of the symptomatology or anterior vitreous gel examination findings. A second prospective group of 115 consecutive patients were assessed in a similar manner before primary rhegmatogenous retinal detachment repair.

Results—In 200 eyes presenting with an acute PVD, 25 were found to have an associated retinal break, 23 of which were also Shafer positive. In 115 eyes presenting for retinal detachment repair, 111 had an associated PVD and were found to be Shafer positive. Symptomatology was not predictive of an associated retinal break in the PVD group or in those presenting with a retinal detachment.

Conclusion—The increased use of Shafer’s sign is recommended as a valuable aid in determining which patients require urgent referral for an expert retinal examination. It is not possible to predict those patients with a retinal break secondary to PVD on the basis of symptomatology alone.

Methods
POSTERIOR VITREOUS DETACHMENT SERIES
Case selection
Two hundred consecutive phakic patients were prospectively recruited over an 18 month period (April 1997 to October 1998) and
assessed in a dedicated clinic at a London teaching hospital. Unselected referrals were made from the emergency department of our hospital, from local primary care physicians or from optometrists in the local community. Only patients over the age of 40 years and presenting with symptoms of an acute PVD within the previous month were recruited. Any patients with a history of previous retinal tear, other ocular disease, previous ocular surgery or symptoms longer than 1 month were excluded.

A validation of patient recruitment using a randomly selected subsample of patients attending the emergency department was undertaken to assess the completeness of the patient recruitment. Recruitment from community sources was encouraged through monthly written reminders.

**History and examination**

An experienced optometrist (DH) documented a detailed history of patient symptoms together with patient age and sex. Following formal refraction and Snellen visual acuity testing, the same optometrist then performed slit lamp biomicroscopy of the anterior segment and anterior vitreous of both eyes but did not examine the fundus. The optometrist recorded the presence or absence of anterior vitreous pigment with no knowledge of whether a retinal break was present. The presence of any other vitreous cells or haemorrhage was also recorded.

A standardised technique was used to perform dynamic examination of the anterior vitreous gel to ensure that any pigment in the gel was visualised. Following pupil dilatation, the anterior vitreous was first examined with an oblique and narrow slit beam at high magnification. If vitreous pigment was not seen the patient was asked to saccade vertically and horizontally. This ocular movement set the vitreous gel in motion ensuring that any pigment cells in the peripheral gel, particularly those cells lying inferiorly, were visualised as the gel passed through the visual axis.

Each patient then underwent 360 degree indentation, indirect ophthalmoscopy by a vitreoretinal surgeon (VT, THW, or AHC), who was unaware of patient symptomatology or vitreous gel examination findings. The vitreoretinal surgeon then determined if a PVD was present using a hand held examination lens and slit lamp biomicroscopy of the posterior hyaloid face. A PVD was documented as being definitely present if a complete or partial ring of glial tissue (a Weiss ring) could be seen on the posterior hyaloid face. In our PVD series we included 27 patients who presented with classic history of acute PVD and at least partial detachment of the hyaloid face but no definite Weiss ring on examination. Although these patients can not be definitely confirmed to have had a complete separation of the posterior hyaloid face they are included as they would form a significant proportion of those patients presenting with PVD symptoms in clinical practice (13.5% in this study).

If a retinal break was found retinopexy was then carried out using our usual techniques of argon laser or cryotherapy retinopexy. If a retinal detachment was found appropriate treatment was performed and the case was included in the retinal detachment series.

**RETINAL DETACHMENT SERIES**

**Case selection**

A second prospective group of 115 consecutive patients was recruited over the same period from patients presenting to our vitreoretinal unit for primary rhegmatogenous retinal detachment repair. Any patients with a history of retinopexy to a previous retinal tear, previous retinal detachment repair, retinal detachment due to trauma or retinal detachment associated with proliferative vitreoretinopathy were excluded. Any patient who had previously undergone any form of intraocular surgery including cataract surgery was also excluded.

**History and examination**

A history of symptoms before the development of retinal detachment was taken. Any symptoms reported as occurring more than 1 year before presentation were assumed not to be directly related to the current retinal detachment and excluded from subsequent analysis. All patients also underwent dynamic examination of the anterior vitreous gel, using the techniques described above, with emphasis on the detection of any pigment granules in the vitreous before surgery.

**STATISTICAL ANALYSIS AND VALIDATION**

All data were entered into a computer database and analysed using SPSS (Statistical Package for Social Sciences, 1995). Continuous variables were analysed using Student's t test and the $\chi^2$ test was used for categorical variables.

Validation using a 1 month subsample of patients attending the emergency department identified that 8/12 (67%) patients suitable for inclusion were referred to the study. Reasons for non-referral were non-intentional and identified as administration error or workload pressure. A comparison of the demographic and clinical features revealed no substantive differences between the two groups. Although there were no validation checks on the recruitment of patients through the community, the age and sex distribution was not significantly different from that of the emergency department group.

**Results**

**POSTERIOR VITREOUS DETACHMENT SERIES**

**Baseline data and symptomatology**

Of 200 patients enrolled in the PVD series, there were 81 males and 119 females with a mean age of 61.6 years (range 41–84 years). There was no significant difference ($p=0.39$) in mean male age (60.9 years) compared with mean female age (62.2 years). Eighty nine patients were referred from the emergency department of our hospital, 78 from local community optometrists, and 33 from local primary care physicians. The posterior vitreous detachment was symptomatic in the right eye.
Percentages given to one decimal place.

PVD = posterior vitreous detachment.

### Presenting symptoms in patients from the retinal detachment series

<table>
<thead>
<tr>
<th>PVD series, no retinal break (n = 115)</th>
<th>Floaters only (38.8%)</th>
<th>Flashes only (14.3%)</th>
<th>Floaters and flashes (45.7%)</th>
<th>Blurring of vision (1.4%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVD series, retinal break present (n = 25)</td>
<td>15 (60%)</td>
<td>1 (4%)</td>
<td>9 (36%)</td>
<td>0</td>
</tr>
</tbody>
</table>

### Presenting symptoms in patients from the PVD series

<table>
<thead>
<tr>
<th>No of eyes (total = 115)</th>
<th>Floaters only (51.3%)</th>
<th>Flashes only (20.9%)</th>
<th>Floaters and flashes (19.1%)</th>
<th>Blurring of vision (0.8%)</th>
</tr>
</thead>
</table>

### Table 2: Vitreous examination findings in PVD and RD series

<table>
<thead>
<tr>
<th></th>
<th>PVD and retinal break (n=25)</th>
<th>PVD no retinal break (n=175)</th>
<th>RD (n=113)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shafer positive</td>
<td>23</td>
<td>0</td>
<td>111</td>
</tr>
<tr>
<td>Shafer negative</td>
<td>2</td>
<td>175</td>
<td>2</td>
</tr>
<tr>
<td>Haemorrhage present</td>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>White cells present</td>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
</tbody>
</table>

PVD = posterior vitreous detachment; RD = retinal detachment.

Spherical equivalent in this eye was −2.00, a definite Weiss ring was present. No pigment was seen in the anterior vitreous gel, fundal examination revealed a small, round, chronic hole in the temporal periphery with an associated free floating operculum and extensive subretinal pigmentation around the hole margins. No retinopexy was carried out as the break was felt to be long standing.

### Case 2

A 69 year old woman presented with a 4 day history of floaters and light flashes in her left eye. Spherical equivalent was +4.00 dioptries and a definite Weiss ring was present. No pigment was seen in the anterior vitreous gel, fundal examination revealed a small superotemporal fresh horseshoe retinal tear which was treated with laser retinopexy.

Of the 200 eyes, vitreous haemorrhage was present in 10 eyes and a Weiss ring was seen in 173 eyes. Eight eyes were noted to have several white cells in the anterior vitreous gel, all of these eyes were Shafer negative and none had an associated retinal break.

### Retinal detachment series

#### Baseline data and symptomatology

Of 115 patients enrolled in the retinal detachment (RD) series, there were 65 males and 50 females with a mean age of 57 years (range 13–88 years). There was no significant difference (p=0.64) in mean male age (56 years) compared with mean female age (58.2 years). Refractive error was myopic in 56 (48.7%).

A total of 68 patients presented within 1 month of onset of symptoms, 31 of these patients presented within 1 week of onset of symptoms. The mean duration from onset of any symptoms to presentation was 63 days. Presenting symptoms for the RD series are shown in Table 3. The majority of patients in the RD series, 105 eyes (91.3%), presented with visual or field loss, either in conjunction with flashes or floaters in 83 eyes (72.2%) or alone in 22 (19.1%) eyes. Of the 83 eyes presenting with additional flashes or floaters, a total of 59 patients gave a definite history of sudden onset of flashes or floaters before the development of a visual field defect or visual loss. Other presentations included floaters alone in four (3.4%) eyes, flashes alone in three (2.6%), flashes and floaters only in one (0.8%) eye, and asymptomatic in two (1.7%) eyes.

### Shafer’s sign

A total of 111 eyes were classified as Shafer positive as shown in Table 2. In one eye the anterior vitreous could not be seen clearly because of dense cataract and in one eye the Shafer sign was not documented. Therefore, two eyes were Shafer negative in the presence of a retinal tear or hole and symptom duration was grouped as follows: 2 days or less six eyes, 1 week or less five eyes, 1 week to 1 month 130 eyes.

### Case 1

A 64 year old man presented with a 3 week history of floaters and light flashes in his right eye. Presenting symptoms and vitreous findings for the PVD series are shown in Table 1. The presenting symptom in the PVD series was floaters alone in 83 eyes, light flashes alone in 26 eyes, floaters and light flashes together in 89 eyes, and vague blurring of vision in two eyes. Symptom duration was grouped as follows: 2 days or less 14 eyes, 1 week or less 56 eyes, 1 week to 1 month 130 eyes.

Shafer’s sign

A total of 177 (88.5%) eyes were classified as Shafer negative and 23 (11.5%) eyes as Shafer positive as shown in Table 2. In those patients who were Shafer positive the average age was 57.5 years, there were 12 males and 11 females with an average refraction of −1.7 dioptries spherical equivalent (range −21.5 to +5 dioptres), a total of 78 eyes (39%) eyes had a myopic spherical equivalent.

Shafer’s sign

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### Table 3: Presenting symptoms in patients from the retinal detachment series

<table>
<thead>
<tr>
<th>Floating or visual loss preceded by flashes or floaters</th>
<th>Field or visual loss with simultaneous flashes or floaters</th>
<th>Field or visual loss alone</th>
<th>Floaters only</th>
<th>Flashes only</th>
<th>Floaters and flashes</th>
<th>Asymptomatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of eyes (total = 115)</td>
<td>59 (51.3%)</td>
<td>24 (20.9%)</td>
<td>22 (19.1%)</td>
<td>4 (3.4%)</td>
<td>3 (2.6%)</td>
<td>1 (0.8%)</td>
</tr>
</tbody>
</table>

Percentages given to one decimal place.
Acute posterior vitreous detachment

of a retinal detachment. Neither of these patients had premonitory symptoms, their reti
nal detachments having been discovered fol-
lowing a routine eye examination. Neither
patient had developed a posterior vitreous
detachment and the retinal detachment in each
case was inferior, long standing, and secondary
to round retinal holes in the absence of lattice
degeneration.

**Discussion**

The incidence of retinal break formation
following acute posterior vitreous detachment
is variously reported as occurring in between
8% to 15% of patients in studies similar to ours. The incidence of retinal break forma-
tion in our PVD series of 12.5% is therefore
consistent with that previously reported.

Of 200 patients who presented with an acute
PVD, a significantly greater proportion were
female (59.5% vs 40.5%, p=0.003). Byer has
suggested that the apparent higher frequency
of PVD in females is the result of the higher
incidence of females in the general population
at the age of PVD. He supported this theory
with a comparative control group drawn from
new patients presenting to his practice, and
found no statistically significant difference in
sex between this control group and those
presenting with PVD. However, of 115 patients
presenting for RD repair, 65 were male and 50
female (p=0.007), and of the 25 patients in our
PVD series who were found to have retinal
breaks there were 13 males (16%) and 12
females (10%). This significant association
between male sex and PVD being associated
with a retinal break or of presenting with a rheg-
matogenous RD ( χ²=13.54 p<0.001) is similar
to the reports of several other authors includ-
ing Byer, but has no obvious explanation. Despite careful history taking it was not pos-
sible on the basis of symptoms alone to deter-
mine which patients had a retinal break conse-
quently to a PVD, a finding confirmed by
previous authors. Some authors have
suggested that vitreous floaters alone carry a
much less significant risk of retinal tear than
when present in conjunction with flashes. It is
interesting that in our PVD series 83 eyes
presented with floaters only, of which 15 eyes
had associated retinal breaks, and 89 eyes pre-
sented with a combination of flashes and float-
ers, of which nine eyes had associated retinal
breaks. Therefore, symptoms of floaters alone
was associated with a retinal break in 18.1% of
cases and symptoms of flashes and floaters
together was associated with a retinal break in
10.1% of cases. The combination of flashes and
floaters together did not have a significa-
cantly higher chance ( χ²= 1.65, p=0.19) of
being associated with a retinal tear than
floaters alone. In our series it was not possible
to determine on the basis of symptoms alone
which patients with an acute PVD were more
likely to have an associated retinal break and
need urgent expert retinal examination.

In our series of 115 patients presenting with
retinal detachment 59 patients reported defi-
nite onset of symptoms of floaters or flashes
before the onset of field or visual loss, four
patients presented with floaters alone, three
with flashes alone, and one with floaters and
flashes. It is interesting to note that 22 patients
(19.1%) presented with field or visual loss and
no other symptoms. While emphasising the
importance of expert retinal examination in
patients presenting with symptoms of PVD
these observations do not help in determining
which symptoms are more likely to be associ-
ated with a retinal break or detachment.

However, we have found the presence of pig-
ment in the vitreous gel to be a reliable indica-
tor of the presence of a retinal break in associa-
tion with an acute PVD, occurring in 23/25
(92%) patients. We did not detect pigment in
the vitreous gel of any patient who did not have
a retinal break. Of the two patients in the PVD
series with retinal breaks who did not have vit-
reous pigment, one was found to have a round
hole present in an area of lattice type retinal
degeneration. We suspect that the hole had
been present for a significant time before the
development of PVD since there was extensive
pigmentation around the hole margins. If this
patient is excluded the correlation between vit-
reous pigment and retinal break rises to 23/24
giving a sensitivity of 95.8% and a specificity of
100%.

The positive association between vitreous
pigment and retinal break was confirmed by
our study of those patients presenting with
retinal detachment. All patients with sympto-
matic retinal detachment in whom Shafer’s
sign was documented were found to have vitre-
ous pigment. Interestingly, vitreous pigment
was absent in two patients in the retinal
detachment group, both of whom had asymptom-
tic retinal detachments secondary to
round holes not associated with lattice degener-
ation in the absence of a PVD. The
pathogenesis of break formation in these
patients is due to a posterior vitreous gel
break secondary to vitreoretinal traction
following PVD. Either this process does not
result in the release of pigment or only a
small amount of pigment is released. It is also
possible that the absence of a posterior vitreous
detachment inhibits dispersion of pigment
through the gel. It is important to emphasise
that dynamic vitreous gel examination should
be performed as the amount of vitreous
pigment present is often small and may settle
inferiorly making it difficult to see unless the
vitreous gel is set in motion. 1 16

Vitreous pigment appears in the anterior vitreous gel
almost immediately after break formation, and
was seen in retinal tears of only a few hours’
duration. It is important to emphasise that the
strong positive correlation found in our study
between vitreous pigment and retinal tear may
apply only to those patients with acute PVD of
recent onset. However, this group of patients
comprises those at greatest risk of retinal
detachment secondary to a retinal break. Our
series is also not a community based study and
it is therefore difficult to completely exclude a
possible referral bias in patients presenting to
our tertiary referral practice, despite our
attempts to encourage referral of all patients
with acute PVD on an unselected basis.
Brod et al. have performed a similar study to ours looking at 106 patients with acute PVD and also found a high correlation between vitreous pigment and retinal break with 15 eyes having pigment cells in the vitreous gel out of 16 eyes with a retinal tear. Other retrospective studies of patients presenting with retinal detachments have found a weaker correlation (83%, 93%) (5).

Of 200 patients in the PVD series we identified eight patients with an unusual number of white cells within their vitreous but no other evidence of intraocular inflammation and no retinal break. It is therefore important to note the colour as well as presence of vitreous cells when trying to assess the risk of an underlying retinal break. It may be occasionally difficult to differentiate red blood cells from pigmented cells in the vitreous, although the pigment cells usually appear larger, darker and more irregular in shape. We were able to differentiate pigment cells from red blood cells in one of our patients who presented with a retinal tear and associated mild vitreous haemorrhage, but this may be more difficult in cases where the vitreous haemorrhage is particularly dense.

We therefore believe the use of Shafer’s sign offers an extremely valuable aid in the examination of patients with acute PVD. If vitreous pigment is seen in the absence of previous ocular surgery it should be assumed a retinal break is present and the patient should be referred immediately for expert retinal examination and treatment. We recommend that those patients with acute PVD and no vitreous pigment be referred for expert opinion on a less urgent basis. Further examination is probably still necessary owing to the occasional difficulty in observing very small amounts of vitreous pigment in some patients with small retinal tears, the occasional patient who has an acute retinal tear in the absence of vitreous pigment, and the possible, rare, occurrence of delayed retinal breaks.

1 Byer NE. Natural history of posterior vitreous detachment with early management as the premier line of defence against retinal detachment [see?]. Ophthalmology 1994;101:1503–13.
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