Retinal Detachment in the Endophthalmitis Vitrectomy Study

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Objectives: To assess the frequency of retinal detachment following postcataract endophthalmitis and to evaluate the results of management of these detachments.

Methods: Prospective data collected as part of the Endophthalmitis Vitrectomy Study were analyzed. The study was a randomized clinical trial testing the roles of vitrectomy and intravenous antibiotics in restoring vision in patients with endophthalmitis following cataract surgery.

Results: The incidence of retinal detachment was 8.3% after treatment of endophthalmitis, with no difference in frequency based on whether initial management was vitrectomy or tap biopsy. The frequency of detachment was higher with more virulent organisms, poor presenting visual acuity, an open posterior capsule at presentation, and in patients who required an early additional procedure in the management of their endophthalmitis. Retinal detachment resulted in a poor visual outcome, with only 27% of patients achieving 20/40 final visual acuity compared with 55% of patients who did not develop detachment. Patients who were able to undergo surgery for their detachment had a better result, with 38% achieving 20/40 final visual acuity. Anatomic success after surgical repair of detachment was achieved in 78% of patients.

Conclusion: Retinal detachment is a poor prognostic indicator following endophthalmitis, but surgical repair can salvage excellent vision in a substantial number of patients.

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Retinal detachment is a complication both of endophthalmitis as well as of the surgical procedures used in its treatment. In the management of endophthalmitis, Nelsen et al reported retinal detachment rates of 21% after vitrectomy procedures and 9% for eyes not treated with vitrectomy, with an overall retinal detachment rate of 16% after endophthalmitis. Olson and colleagues reported an overall retinal detachment rate of 10% following treatment of postsurgical endophthalmitis, with again a higher rate of 14% in vitrectomized eyes. A different report showed a frequency of retinal detachment of 4% following treatment for postcataract extraction endophthalmitis. Although previous literature has described a higher detachment rate among eyes treated with vitrectomy, that literature has been based on nonrandomized and retrospective studies in which the most severe eyes underwent vitrectomy.

The purpose of this report from the Endophthalmitis Vitrectomy Study (EVS) is to describe the incidence of retinal detachment in a large series of patients treated for endophthalmitis after cataract extraction or secondary lens implantation. The article examines risk factors for retinal detachment in patients with endophthalmitis, and it describes the treatment and final outcome of patients who developed retinal detachment after endophthalmitis.

RESULTS

INCIDENCE OF RETINAL DETACHMENT AND ASSOCIATION WITH PRESENTING FINDINGS

Retinal detachment occurred after treatment in 35 (8%) of 420 patients in the EVS. In the EVS, patients were randomized to initial 3-port vitrectomy (VIT) or initial vitreous needle aspiration or mechanical biopsy removing no more than 0.3 mL (TAP). As shown in Table 1, there was no significant difference in retinal detachment development between VIT and TAP, at 7.8% and 9.0%, respectively.

A complete list of the members of the Endophthalmitis Vitrectomy Study Group was published previously (Arch Ophthalmol. 1995;113:1493-1495).
PATIENTS AND METHODS

Patients were eligible for entry into the EVS if they developed clinical evidence of endophthalmitis within 6 weeks of cataract extraction or secondary lens implantation. Their visual acuity had to be no better than 20/50 and no worse than light perception (LP). Patients were not eligible for study entry if they came to us with retinal detachment. The full list of eligibility characteristics is presented elsewhere.4 All patients gave informed consent for study participation.

Of the 420 patients entered into the EVS, 35 developed retinal detachment at some time during the 9- to 12-month follow-up. Of these 35 patients, 5 did not return for the final visit at 9 to 12 months. None of these 3 patients had lost LP or had undergone enucleation at the time of their last study visit. Results of final visual acuity status are based on the 30 patients who returned for the final follow-up visit. As a secondary analysis, we examined all 35 patients, assuming the worst possible visual acuity outcome (no LP) for those who did not return for the 9-month follow-up visit. The data for the primary clinical trial results of the EVS were analyzed according to the intention-to-treat principle; that is, patients were included in the group to which they were assigned at random. This article addresses complications, so it is based on the procedure actually received. Since previous reports of the EVS,4 further data have been obtained regarding retinal detachment. This explains minor discrepancies in the total number.

The differences in the retinal detachment rate within subgroups defined by baseline characteristics and patient presentation were compared using a χ² test. The difference in the time to a retinal detachment by initial surgery type was tested using a log-rank statistic. Of those with a retinal detachment, the percentages of patients meeting the visual acuity thresholds with corrective surgery and without corrective surgery were compared using a χ² test.

Within the TAP group, the retinal detachment rate was 11% (8/70) with needle aspiration, similar to the rate of 8% (10/127) for those who had mechanical vitreous biopsy. In 4 patients, the procedure was initiated with needle aspiration but converted to biopsy, and there were no detachments among these patients. The rate of retinal detachment was 11% (24/214) among eyes not treated with systemic antibiotics, and compared with 5% (11/206) among eyes that were treated with systemic antibiotics.

The retinal detachment rate was related to initial microbial pathogenic findings. Rates were relatively low among those eyes with no growth (5%) or Gram-positive coagulase-negative growth (5%). Higher rates were seen for more virulent organisms, at 12% for Gram-negative organisms and 23% for “other” Gram-positive organisms (the term used in the EVS to describe all Gram-positive organisms that were not coagulate-negative micrococci). This difference was significant at P = .001.

The development of retinal detachment was strongly associated with presenting visual acuity, occurring in 16% of patients who came to us with LP only and in 6% of those who came to us with better than LP (P = .004).

Patients older than 75 years were more likely to develop retinal detachment than were younger patients. History of diabetes was not related to the development of retinal detachment.

Patients who came to us with an intact posterior capsule had a 2.4% incidence of retinal detachment compared with those in whom the status of the capsule at presentation could not be determined, where the incidence was 10.1%, and with those in whom the capsule was definitely open at presentation, where the incidence was 20.4% (P < .001). When analyzed separately in the VIT and TAP groups, the data regarding capsule status and detachment rate are similar. The detachment rate in the TAP group was 2.5% with intact capsule and 22.5% with open capsule, vs 2.4% and 18.2%, respectively, in the VIT group.

Patients who had an early additional procedure (defined as an additional surgical procedure within 7 days of study entry) had a much higher incidence of retinal detachment of 18% (8/44) compared with 7%
(27/376) of patients who did not have an early additional procedure (P = .01).

When retinal detachment developed, it tended to develop relatively early. Of the 35 retinal detachments diagnosed in this study, 11 (31%) occurred within 1 month of the initial procedure, 15 (43%) within 2 months, and 21 (60%) within 3 months. There was no significant difference in median time to diagnosis of retinal detachment in VIT vs TAP eyes. For VIT eyes, the median time until diagnosis of retinal detachment was 82 days (interquartile range, 67-131 days), and for TAP eyes, 87 days (interquartile range, 25-120 days) (P = .63).

**SURGICAL REPAIR**

Surgery was performed for retinal detachment in 66% (23/35) of patients. In Table 2, the surgical procedures were grouped by the most invasive procedure, with each patient listed in only one category. Vitrectomy, with or without scleral buckling, was the surgical procedure in 57% (13/23) of patients, and scleral buckling without vitrectomy was performed in 35% (8/23). Two (9%) of 23 patients had retinopexy for localized retinal detachment.

For patients who did not undergo a surgical procedure for retinal detachment, the reasons were phthisis, patient refusal, and assorted other conditions that made attempts at surgical repair inadvisable.

Only half the patients who came to us with LP-only visual acuity and developed a retinal detachment underwent surgery, whereas 82% (14/17) of those who came to us with better than LP visual acuity underwent surgical repair.

There was no significant difference in the rate at which attempt to achieve surgical repair was performed based on whether the patient was in the VIT or TAP group. Of the 17 VIT eyes that developed retinal detachment, 12 (71%) underwent surgical repair compared with 11 (61%) of the 18 TAP eyes.

The frequency of attempts to achieve surgical repair of retinal detachment was not related to when, in the course of follow-up, the detachment was diagnosed. For the 15 patients who developed detachment within 2 months after study entry, 10 underwent surgical repair compared with 13 of the 20 patients who developed detachment more than 2 months after study entry.

**VISUAL ACUITY**

Table 3 shows final visual acuity results for 394 patients assessed at the final EVS follow-up. The table compares results for all patients who did not develop detachment with results for those who did. Among those with detachment, it compares visual acuity results of those who underwent surgery with results of those who did not.

Patients who developed retinal detachment fared poorly. For the 30 patients who developed retinal detachment and for whom final study follow-up was available, only 26% (8/30) achieved 20/40 visual acuity compared with 55% (201/364) of patients who did not have a retinal detachment. More than half (16/30) of the patients with retinal detachment had final visual acuity worse than 5/200, compared with only 29 (8%) of those without retinal detachment.

Patients who had surgical repair of retinal detachment did better than those without surgical repair. Of those who had surgical repair, 38% (8/21) achieved 20/40 visual acuity. Although only 7 (33%) patients undergoing surgery had results worse than 5/200, all patients who did not undergo surgery had visual acuity worse than 5/200.

Among patients undergoing surgery for retinal detachment, the presenting visual acuity was correlated with the visual acuity results. Patients who came to us with less than LP visual acuity and underwent surgery for detachment had a 57.1% chance of achieving 20/40 and a

Table 2. Type of Surgery or Reason for No Surgery for Retinal Detachment (RD) in 420 Patients

<table>
<thead>
<tr>
<th>No. of Patients</th>
<th>Percentage of Those With RD</th>
<th>Percentage of Those With Surgical Repair</th>
<th>Percentage of Those Without Surgical Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>No RD</td>
<td>385</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>RD with surgical repair</td>
<td>23</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Vitrectomy</td>
<td>13</td>
<td>37.1</td>
<td>56.5</td>
</tr>
<tr>
<td>Scleral buckling</td>
<td>8</td>
<td>22.8</td>
<td>34.8</td>
</tr>
<tr>
<td>Cryosurgery or laser</td>
<td>2</td>
<td>5.7</td>
<td>8.7</td>
</tr>
<tr>
<td>RD without surgical repair</td>
<td>12</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Phthisis</td>
<td>7</td>
<td>29.0</td>
<td>58.3</td>
</tr>
<tr>
<td>Refused</td>
<td>2</td>
<td>5.7</td>
<td>16.7</td>
</tr>
<tr>
<td>Central retinal vein occlusion</td>
<td>1</td>
<td>2.9</td>
<td>8.3</td>
</tr>
<tr>
<td>Optic nerve damage</td>
<td>1</td>
<td>2.9</td>
<td>8.3</td>
</tr>
<tr>
<td>Enucleation</td>
<td>1</td>
<td>2.9</td>
<td>8.3</td>
</tr>
</tbody>
</table>

*NA indicates not applicable.

Table 3. Visual Acuity Outcome by Retinal Detachment (RD) Status for 394 Patients With Final Follow-up Data Available*

<table>
<thead>
<tr>
<th>No. of Patients</th>
<th>Visual Acuity</th>
</tr>
</thead>
<tbody>
<tr>
<td>RD</td>
<td>≥20/40</td>
</tr>
<tr>
<td>364</td>
<td>201 (55.2)</td>
</tr>
<tr>
<td>RD with surgery</td>
<td>21</td>
</tr>
<tr>
<td>RD without surgery</td>
<td>9</td>
</tr>
</tbody>
</table>

* This table is based on final follow-up visit information. Since there were 5 patients who developed RD who did not return for the final follow-up visit, this table shows data only for the 30 patients with RD who were assessed at the final visit. Data are given as number (percentage).
78.6% chance of achieving 20/100 final visual acuity. However, no patients who came to us with LP only visual acuity and underwent surgery for retinal detachment had visual acuity results as good as 20/100.

The visual acuity results for patients who developed retinal detachment and had surgery for the detachment were similar no matter if the initial treatment allocation was VIT or TAP. Final visual acuity was 20/40 or better in almost 40% (4/10) of these patients from the VIT group and in 36% (4/11) from the TAP group. Thus, the type of initial procedure was not a predictor of visual success rate after retinal reattachment surgery.

The final follow-up data were assessed to determine whether the visual outcome varied depending on when the detachment developed. Among the 6 patients who developed detachment within 2 months from study entry and had final follow-up data, 2 (33%) had final visual acuity of 20/40 or better compared with 6 (25%) of the 24 who developed detachment more than 2 months from study entry (P = .68). Data are similar for the other visual thresholds of 20/100 and 5/200.

Among 5 of the 35 patients with retinal detachment who were missing final study vision data, 2 had undergone surgery for their detachment and 3 had not. It is likely that most or all of the patients who did not return for final follow-up had poor final results, though of course we cannot know. If we make the assumption that all 5 patients had final visual acuity worse than 5/200, then the data in Table 3 would change among patients who underwent surgical repair of their detachment to 8 (35%) of 23 had 20/40 or better, 11 (48%) of 23 had 20/100 or better, and 14 (61%) of 23 had final visual acuity of 5/200 or better.

For those not receiving surgery, the data in Table 3 would remain identical except the number would change from 9 to 12. Continuing with this assumption, for all 35 patients, the data would change to 8 (23%) achieving 20/40 visual acuity compared with 201 (55%) of the 364 patients who did not have detachment.

ANATOMIC SURGICAL SUCCESS

Of the 23 patients who had surgery for their detachment, 2 were lost to follow-up. Anatomic success (defined as reaching the surgical goal of the reparative procedure) was achieved with reattachment in 17 and with walling off the detachment in 1. Successful surgical repair was therefore achieved in 18 (78%) of 23 patients if one assumes that the 2 lost to follow-up were treatment failures.

Of the 9 patients who developed LP-only visual acuity and who underwent surgery for retinal detachment, anatomic success was achieved in 6 (67%). Of the 14 patients with retinal detachment who presented with hand motions or better vision and underwent repair, 12 (86%) were successfully repaired.

COMMENT

In the EVS, retinal detachment occurred with a frequency of approximately 8% after treatment for endophthalmitis. There was no significant difference in retinal detachment rate whether an initial vitrectomy was performed. This differs substantially from findings in the previous literature. Olson and colleagues reported a 14% detachment rate with vitrectomy and 5% without, and Nelsen et al reported a 21% detachment rate with vitrectomy and 9% without. The earlier literature was hindered by case selection bias whereby patients treated by vitrectomy had generally the worst eyes. This accounts for the previous concerns that detachment developed more frequently in vitrectomized eyes. The present study indeed shows that patients who sought care because of more invasive organisms or with worse initial vision had a higher retinal detachment rate. These were the types of eyes that underwent vitrectomy in prior reports.

The results from this study show that the retinal detachment rate was lower in eyes treated with systemic antibiotics compared with those not treated with systemic antibiotics. In the EVS, overall visual results were the same for patients who received and those who did not receive systemic antibiotics. We cannot think of any logical reason why systemic antibiotics would result in a decreased retinal detachment rate and believe this result was owing to chance.

There are a number of factors associated with the initial presentation of patients with endophthalmitis that correlate with an increased retinal detachment rate. Retinal detachment is more likely to develop in patients who have the most severe presentation, with visual acuity of LP only or with the most aggressive organisms, including Gram-negative and other Gram-positive bacteria. Similarly, retinal detachment was much more likely in patients whose course was such that they required an early additional procedure than in patients who did not.

Retinal detachment was more likely to develop in eyes that had open posterior capsules than in eyes that had intact capsules, a finding that is perhaps not surprising in view of the association of capsule opening with retinal detachment when endophthalmitis is not present. An open capsule at presentation is probably an indicator that there were substantial difficulties at the initial cataract operation. Indeed, results of the EVS have already shown that an open capsule at presentation was one of the statistically significant independent risk factors at the initial ocular examination that were predictive of decreased final vision.

One concern that had existed was whether vitreous aspiration might cause undue traction on the retina, possibly resulting in a higher retinal detachment rate. The rate was no different within the TAP group whether the procedure was performed with needle aspiration or with mechanical vitreous biopsy. However, because the study design allowed the surgeon to select which type of TAP procedure to perform, the allocation to aspiration or vitreous biopsy was not random. Therefore, one cannot necessarily conclude that the 2 techniques are equally safe.

Surgical repair was attempted in 2 of 3 patients who developed retinal detachment. Repair was undertaken more frequently when the presenting visual acuity was better than LP compared with when it was LP only. The operability of retinal detachment was not, however, related to whether the patient received TAP or VIT as ini-
tial therapy. One third of patients with retinal detachment were inoperable, primarily because of phthisis.

When retinal detachment developed in the postoperative course of endophthalmitis, the prognosis was poorer than when it did not. Although 20/40 visual acuity was achieved in 55.2% of patients in the EVS who did not develop retinal detachment, it was achieved in only 26.7% of those with retinal detachment.

Although retinal detachment is a poor prognostic sign in endophthalmitis, surgical repair can achieve good visual results in operable patients. Almost 40% of patients who were operated on achieved final visual acuity of 20/40. Baseline factors such as the presence of LP-only visual acuity were predictors of poor results among patients who developed detachment. However, the type of initial treatment for endophthalmitis (TAP vs VIT) and the time when the detachment developed were not associated with a difference in outcome.

Anatomic reattachment was achieved in 78.3% of those undergoing surgical repair, but this translates to only about half the entire group with retinal detachment. Nelsen, Ficker, and Olson and their colleagues reported reattachment in 6 of 7, 2 of 3, and 2 of 4 patients, respectively, who underwent surgical repair for retinal detachment after endophthalmitis. Anatomic success with retinal detachment surgery after endophthalmitis occurs at a far lower rate than after surgical repair of retinal detachment following cataract surgery not complicated by endophthalmitis. The management of retinal detachment in the setting of endophthalmitis may be far more complicated by limited visualization, by more inflammation and its effects on the vitreous and retina, and, in some cases, by the use of intravitreal gas in the presence of intravitreal antibiotics.

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REFERENCES


Correction

Error in Letter. In the letter by Endo et al titled “The BB Gun Is Equivalent to the Airsoft Gun in the Japanese Literature,” published in the May issue of the ARCHIVES (2000;118:732), the visual acuity was indicated for either the right eye or the left eye and should have read “...all but one had a final visual acuity better than 20/32.” In addition, the value for kinetic energy should have been 0.4 J throughout the letter and was printed in one instance as 4.0 J. The journal regrets the errors.

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