Effect of Perifoveal Tissue Dissection in the Management of Acute Idiopathic Full-Thickness Macular Holes

Raymond R. Margherio, MD; Alan R. Margherio, MD; George A. Williams, MD; David R. Chow, MD; Michael J. Banach, MD

Objective: To evaluate the efficacy of perifoveal tissue dissection (PTD) on patients undergoing pars plana vitrectomy for idiopathic macular holes of less than 1-year's duration.

Methods: Pars plana core vitrectomy was performed on 107 eyes of 104 consecutive patients with acute idiopathic macular holes. One cohort had routine PTD. In the other cohort, no attempt was made to strip preretinal tissue. Follow-up was longer than 6 months (follow-up range, 6 to 36 months).

Results: Overall, 95 (89%) of all macular holes were closed. Visual acuity improved 2 lines or more of the Snellen letter chart in 91 eyes (85%). A postoperative visual acuity of 20/50 or better was achieved in 79 eyes (74%). A transient increase in intraocular pressure (≥30 mm Hg) developed in 25 eyes (23.4%). In 6 eyes (5.6%) a retinal detachment developed. One eye had retinal pigment epithelial changes and 1 patient reported peripheral field loss. No statistically significant differences were noted between eyes having PTD and those without PTD for any outcome measure.

Conclusion: In this series, no beneficial or adverse effect could be demonstrated by performing PTD in eyes undergoing pars plana core vitrectomy for acute idiopathic macular holes.


In 1991, Kelly and Wendel1 first reported a technique for the surgical repair of macular holes with an initial anatomical success rate of 58%. This rate increased to 83% in a series reported in 1994.2 Subsequent investigators modified various aspects of the technique in an attempt to improve the anatomical and visual results. Modifications included using various adjuvant treatments, including transforming growth factor-β2,3 autologous serum,4,5 thrombin,6,7 and platelet extracts.8,9 Others modified the duration of intraocular tamponade10 or the need for postoperative prone positioning of the patient.11 Silicone oil has also been suggested as a substitute for long-acting gas to try to eliminate the need for prone positioning altogether or to use in patients unable to maintain a prone position because of physical limitations or age.12 The routine and meticulous removal of preretinal tissue and/or ILM has also been suggested as a means of improving surgical results.11,13,14 However, the role of removal of preretinal tissue and/or ILM in macular hole surgery is uncertain.

RESULTS

Table 1 summarizes the characteristics of the eyes included in this study. A total of 107 eyes from 104 patients met the criteria for inclusion in this study. Using the Gass classification, there were 13 stage 2 and 94 stage 3 macular holes. All eyes were operated on within 1 year of the develop-
MATERIALS AND METHODS

We reviewed 340 cases of idiopathic macular hole of less than 1 year’s duration, performed in the 3-year period beginning December 1, 1994, extending to November 30, 1997.

In reviewing operative notes, we found that 2 surgeons (R.M. and G.A.W.) in Associated Retinal Consultants, Royal Oak, Mich, performed the surgical procedure exactly the same way except that the first surgeon never attempted to peel preretal tissue/ILM and the second surgeon always made an attempt to remove preretal tissue/ILM. We believed that comparing the consecutive series of patients operated on by these 2 surgeons using the same time frame would give some indication as to the possible importance of perifoveal tissue dissection (PTD). Only primary operated on cases are considered, and any late reopening of an initially successfully closed hole was considered a surgical failure.

One hundred seven eyes were included in this study. All met the criteria noted earlier and were operated on consecutively by the 2 surgeons between December 1, 1994, and November 30, 1997.

A complete eye history was obtained and an ophthalmic examination was performed, including indirect ophthalmoscopy with scleral depression, evaluation of the macula with a 90-diopter lens or contact macular lens, and fundus photography with fluorescein angiography. In addition, a Watzke-Allen test was performed on each eye. In cases with an equivocal Watzke-Allen test result, microperimetry was done using the 50-µm laser aiming beam. Standardized visual acuity was obtained using an autorefractor (model 585; Allergan Humphrey, San Leandro, Calif) both preoperatively and postoperatively. Any complications were noted and treated as necessary.

The surgical procedure was similar to that initially described by Kelly and Wendel. In all eyes, a 3-port pars plana vitrectomy was performed. Next the vitrector with end-gripping forceps. In cohort 2 (48 consecutive patients), after stripping the posterior hyaloid and vitreomty, no attempt was made to remove preretal tissue. In both groups, following the waiting period, any additional preretal fluid was removed with the soft-tipped cannula. The sclerotomy sites were closed and then 40 mL of 16% perfluoropropane gas was injected through the pars plana with a 30-gauge needle while a second 27-gauge needle, also passed through the pars plana, was used to vent the eye. Prone positioning of the patient was mandated for 2 weeks. Postoperative evaluations were done at days 1, 7, and 21 and at 3-month intervals thereafter. Follow-up ranged from 6 to 36 months.

Visual acuities were converted to logMAR acuities for statistical analysis. Statistical analysis of the data was carried out using Statview (Abacus Concepts Inc, Berkeley, Calif). Final visual outcomes between subgroups were compared using paired t tests. Categorical data such as anatomical hole closure were analyzed using a χ² or 2-tailed Fisher exact test.
there were 9 (18.7%). This difference approached statistical significance (P = .059).

Successful anatomical macular hole closure was achieved in 95 eyes (88.8%). The macular hole was closed in 51 (86.4%) of the 59 eyes where PTD was performed. In the 48 eyes without PTD, the hole was anatomically closed in 44 eyes (91.7%). This difference was not statistically significant (P = .79).

Complications noted intraoperatively and postoperatively consisted of 25 eyes with transient elevations of intraocular pressure (≥30 mm Hg), 6 with retinal detachment, 1 eye with retinal pigment epithelial changes, and 1 eye with visual field loss. All eyes with intraocular pressure elevations were easily managed medically. Fourteen (24%) occurred in the eyes that had PTD and 11 (23%) in eyes that had no stripping. Of the 6 retinal detachments, 3 (5.1%) occurred in eyes that were peeled and 3 (6.3%) in the eyes that were not peeled. This difference was not statistically significant (P = .79). The eyes with the retinal pigment epithelial changes and the field loss were both in cohort 1.

The average duration of symptoms in all eyes operated on was 2.87 months, (2.91 months for the peeled eyes and 2.81 months for the nonpeeled eyes; P = .81).

Mean length of follow up was 13.4 months in cohort 1 and 12.8 months in cohort 2 (P = .538).

The eyes in this study were operated on over a 3-year period. Table 2 summarizes the successfully closed macular holes with respect to the year operated on. In the first year, December 1, 1994, to November 30, 1995, a total of 44 eyes were included in the study. Thirty-five (79.5%) of the macular holes were successfully closed. This rate improved to 34 (96.3%) of the 36 macular holes in the last year. Similar improvements occurred in each of the 2 cohorts. No statistically significant difference was noted between cohort 1 and 2 in any of the years. However, a statistically significant improvement was noted in the rate of closure between years 1 and 3 overall (P = .047).

In their landmark paper, Kelly and Wendel reported a 58% anatomical success rate in closing macular holes, with 42% of the eyes achieving a visual improvement of 2 lines or more and 25% attaining 20/50 or better vision. Since that initial report, they and others have reported improved anatomical success rates and better visual results. These improvements have been attributed to the use of various adjuvant treatment and modifications in the surgical techniques. Improvements may be attributed to better patient selection, surgeon experience, and compliance with postoperative prone positioning.

Articles discussing the management of macular holes often include epiretinal membrane dissection as an integral part of the surgical procedure. Some indicate that epiretinal membrane stripping is important to achieving surgical success.

One article described a series of patients where epiretinal membrane stripping was specifically omitted. This article attributed the success rate achieved to the use of transforming growth factor-β. We were unable to find an article that specifically compared the presence or absence of PTD in 2 similar groups of patients.

Previous authors reported a significant improvement in rates of closure of macular holes with the use of PTD. In all of these series, however, no attempt was made to compare eyes operated on contemporaneously. Rather, the series compare eyes operated on before and after the institution of PTD. Subtle improvements in surgical technique or surgeon experience may be overlooked in such a comparison. This seems to be

### Table 1. Baseline Data and Results*

<table>
<thead>
<tr>
<th>Data</th>
<th>All Eyes (N = 107)</th>
<th>Cohort 1†</th>
<th>Cohort 2†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (range), y</td>
<td>69.7 (48-88)</td>
<td>69.9</td>
<td>69.4</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>68/107 (63.6)</td>
<td>38/59 (64.4)</td>
<td>30/48 (62.5)</td>
</tr>
<tr>
<td>Male</td>
<td>39/107 (36.4)</td>
<td>21/59 (35.6)</td>
<td>18/48 (37.5)</td>
</tr>
<tr>
<td>Mean duration symptoms, mo</td>
<td>2.87</td>
<td>2.91</td>
<td>2.81</td>
</tr>
<tr>
<td>Stage of macular hole</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>13/107 (12.1)</td>
<td>4/59 (6.8)</td>
<td>9/48 (18.7)</td>
</tr>
<tr>
<td>3</td>
<td>94/107 (87.9)</td>
<td>55/59 (93.2)</td>
<td>39/48 (81.3)</td>
</tr>
<tr>
<td>Macular hole closed</td>
<td>95/107 (88.8)</td>
<td>51/59 (86.4)</td>
<td>44/48 (91.7)</td>
</tr>
<tr>
<td>Macular hole closed by stage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>12/13 (92.3)</td>
<td>4/4 (100)</td>
<td>8/9 (88.9)</td>
</tr>
<tr>
<td>3</td>
<td>83/94 (88.3)</td>
<td>47/55 (85.4)</td>
<td>36/39 (92.3)</td>
</tr>
<tr>
<td>Mean preoperative visual acuity (Snellen)</td>
<td>20/126</td>
<td>20/125</td>
<td>20/126</td>
</tr>
<tr>
<td>Eyes with visual acuity ≥20/50</td>
<td>79/107 (73.8)</td>
<td>38/59 (64.4)</td>
<td>41/48 (84.5)</td>
</tr>
<tr>
<td>Visual acuity improved by stage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>91/107 (85)</td>
<td>48/59 (81.4)</td>
<td>43/48 (89.6)</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean follow-up, mo</td>
<td>13.4</td>
<td>13.4</td>
<td>12.8</td>
</tr>
<tr>
<td>Complications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retinal detachment</td>
<td>6/107 (5.6)</td>
<td>3/59 (5.1)</td>
<td>3/48 (6.3)</td>
</tr>
<tr>
<td>↑IOP postoperatively</td>
<td>25/107 (23.4)</td>
<td>14/59 (23.7)</td>
<td>11/48 (22.9)</td>
</tr>
</tbody>
</table>

*The numerator indicates the number of affected patients; the denominator, the total number of patients enrolled in the study; and the parenthetical numbers, percentages.

†Cohort 1 indicates eyes undergoing perifoveal tissue dissection; cohort 2, eyes without perifoveal tissue dissection.

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### Table 2. Effect of Learning Curve on Rate of Closure of Acute Macular Holes*

<table>
<thead>
<tr>
<th>Study Year</th>
<th>Overall (N = 107)</th>
<th>Cohort 1†</th>
<th>Cohort 2†</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35/44 (79.5)</td>
<td>22/29 (75.9)</td>
<td>13/15 (86.7)</td>
</tr>
<tr>
<td>2</td>
<td>34/36 (94.4)</td>
<td>18/19 (94.7)</td>
<td>16/17 (94.1)</td>
</tr>
<tr>
<td>3</td>
<td>26/27 (96.3)</td>
<td>11/11 (100)</td>
<td>15/16 (93.8)</td>
</tr>
</tbody>
</table>

*The numerator indicates the number of affected patients; the denominator, the total number of patients enrolled in the study; and the parenthetical numbers, percentages.
the case in our series in which the overall results of successful macular hole closure improved from 79.5% in the eyes operated on in the first year compared with 96.3% of eyes operated on in the third year. This difference occurred despite the fact that the surgeons performing the operations had each performed more than 50 similar operations prior to December 1, 1994, when the first eye in our series was operated on.

After reviewing the operative notes and interviewing the fellows who assisted in these cases, no specific differences in technique or follow-up could be determined. We speculate that incomplete removal or delamination of the posterior vitreous cortex in some of the earlier cases, as we have previously reported,16 may have been responsible for some of the failures. Delamination of the vitreous cortex can be present and remain undetected even in eyes that have undergone meticulous preretinal membrane dissection.10 We believe that if during the air-fluid exchange, the soft-tipped cannula engages any residual cortical vitreous on the optic disc or over the posterior pole, it is prudent to remove the air and attempt to remove any remaining cortical vitreous before completing the operation.

In our study, we attempted to define the role, if any, of meticulous PTD in the management of acute idiopathic macular holes. In this series of 107 acute idiopathic macular holes, we noted no significant differences in visual acuity or anatomical results between groups before or after surgery. The cohort that did not undergo PTD had slightly better clinical results for anatomical attachment and visual results than the second group, although this was not statistically significant. The complication rates were comparable.

One might theorize that the visual results would be better in the cohort with PTD. Removal of this tissue might result in less metamorphopsia and improved visual acuity. However, this did not appear to be the case here. Conversely, it has also been considered that manipulation of the perifoveal tissue might cause damage to the sensory retina or the underlying retinal pigment epithelium, resulting in poorer visual results. However, except in the 1 eye demonstrating retinal pigment epithelial disruption and poor vision, we did not demonstrate this to be the case.

Six eyes (5.6%) in this series developed rhegmatogenous retinal detachment, postoperatively. This occurred despite careful preoperative, intra-operative, and postoperative examination of the retinal periphery in every case. No exudative retinal detachments occurred. This incidence compares favorably with previous reports and emphasizes the need for careful follow-up of this patient population. The incidence of retinal detachment in previous series was between 0% and 1.4%.17,20,21

This study demonstrated no beneficial or adverse effects of PTD on the rates of anatomical closure or postoperative visual improvement in acute idiopathic macular holes. This suggests that other factors such as postoperative positioning may be more important to anatomical and visual success than PTD. However, a randomized trial is necessary to definitely define the role of PTD in optimizing visual recovery after macular hole surgery.

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REFERENCES


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