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.


I n 1991, Kelly and Wendel 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. 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, autologous serum, thrombin, and platelet extracts. Others modified the duration of intraocular tamponade or the need for postoperative prone positioning of the patient. 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. The routine and meticulous removal of preretinal tissue and/or internal limiting membrane (ILM) has also been suggested as a means of improving surgical results. However, the role of removal of preretinal tissue and/or ILM in macular hole surgery is uncertain.

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 preretinal tissue/ILM and the second surgeon always made an attempt to remove preretinal 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.1 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 vitreomity, no attempt was made to remove preretinal tissue. In cohort 1 (59 consecutive patients) a bent microvitreoretinal blade or a Rice ILM elevator (Synergetics Inc, Fort Collins, Colo) was used to dissect a plane between any preretinal tissue/ILM and the neurosensory retina. The preretinal tissue/ILM was typically identified as a glistening translucent sheet that could be elevated from the retina without retinal bleeding. The dissection was usually begun about 1000 µm from the center of the hole and continued circumferentially to the edge of the hole and at least 2 disc diameters from the center of the hole. The presence of retinal bleeding was used as an indication that the dissection of preretinal tissue/ILM was not proceeding successfully and the dissection was terminated. Successful dissection of the preretinal tissue/ILM was possible in approximately three quarters of the cases. This tissue was then removed with end-gripping forceps. Any additional preretinal 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.

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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 Wendel1 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 then, initial report, they and others2-17 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.11,13,14 One article described a series of patients where epiretinal membrane stripping was specifically omitted.18 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 authors11,13,14 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>Female</td>
<td>68/107 (63.6)</td>
<td>38/59 (64.4)</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>39/107 (36.4)</td>
<td>21/59 (35.6)</td>
</tr>
<tr>
<td>Mean duration</td>
<td>2.87</td>
<td>2.91</td>
<td>2.81</td>
</tr>
<tr>
<td>symptoms, mo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage of macular hole</td>
<td>2</td>
<td>13/107 (12.1)</td>
<td>4/59 (6.8)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>94/107 (87.9)</td>
<td>55/59 (93.2)</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>2</td>
<td>12/13 (92.3)</td>
<td>4/100 (40)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>83/94 (88.3)</td>
<td>47/55 (85.4)</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>Mean postoperative visual acuity (Snellen)</td>
<td>20/50</td>
<td>20/56</td>
<td>20/43</td>
</tr>
<tr>
<td>Eyes with visual acuity ≥3/20/50</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</td>
<td>91/107 (85)</td>
<td>48/59 (81.4)</td>
<td>43/48 (89.6)</td>
</tr>
<tr>
<td>2 or more Snellen lines</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 dissecting; cohort 2, eyes without perifoveal tissue dissection.
‡Transient elevation in intraocular pressure of 30 mm Hg or more.

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 = .39).

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).
the case in our series in which the overall results of success-
ful 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 oc-
curred despite the fact that the surgeons performing the
operations had each performed more than 50 similar op-
erations prior to December 1, 1994, when the first eye in our series was operated on.

After reviewing the operative notes and interview-
ning the fellows who assisted in these cases, no specific
differences in technique or follow-up could be deter-
mined. We speculate that incomplete removal or delami-
nation of the posterior vitreous cortex in some of the ear-
er cases as we have previously reported, 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 mem-
brane dissection. We believe that if during the air-
fluid exchange, the soft-tipped cannula engages any re-
sidual cortical vitreous on the optic disc or over the
posterior pole, it is prudent to remove the air and at-
tempt 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 idiop-
athic macular holes. In this series of 107 acute idiop-
athic macular holes, we noted no significant differ-
ences 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 at-
tachment and visual results than the second group, al-
though this was not statistically significant. The complica-
tion 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 acu-
ity. However, this did not appear to be the case here. Con-
versely, it has also been considered that manipulation of the
perifoveal tissue might cause damage to the neuro-
sensory retina or the underlying retinal pigment epite-
lium, resulting in poorer visual results. However, ex-
cept 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 rhegmatog-
ous retinal detachment, postoperatively. This oc-
curred despite careful preoperative, intra-operative, and
postoperative examination of the retinal periphery in ev-
eye. No exudative retinal detachments occurred. This
incidence compares favorably with previous reports and
emphasizes the need for careful follow-up of this pa-
ient 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 ef-
ects of PTD on the rates of anatomical closure or post-
operative visual improvement in acute idiopathic macu-
lar holes. This suggests that other factors such as post-
operative 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

1. Kelly NE, Wendel RT. Vitreous surgery for idiopathic macular holes: results for a
47-55.
3. Glaser BM, Michels RG, Kuppermann BD, Sjaarda RN, Pena RA. Transforming
growth factor-beta 2 for the treatment of full-thickness macular holes: a pro-
4. Liggett PE, Skold SA, Horie B, et al. Human autologous serum for the treat-
1071-1076.
5. Wells JA, Gregor ZJ. Surgical treatment of full-thickness macular holes using
6. Vinc AD, Johnson MW. Thrombin in the management of full thickness macular
7. Olsen TW, Stemberg P, Martin DF, Capone A Jr, Lim JL, Aaberg TM. Postop-
erative hypopyon after intravitreal bovine thrombin for macular hole surgery. Am
gous platelet concentrate for the treatment of full-thickness macular holes. Graefes
an adjunct in macular hole healing: a pilot study. Ophthalmology. 1996;103:
590-594.
10. Thompson JT, Glaser BM, Sjaarda RN, Murphy RP, Hanham A. Effects of intra-
ocular bubble duration in the treatment of macular holes by vitrectomy and trans-
11. Tornambe PE, Poliner LS, Groth K. Macular hole surgery without face-down pos-
12. Goldbaum MH, McCuen BW, Hanneken AM, Burgess SK, Chen HH. Silicone oil
tamponade to seal macular holes without position restrictions. Ophthalmology.
13. Wendel RT, Patel AC, Kelly NE. Salzano TC, Wells JW, Novack GD. Vitreous sur-
14. Rice TA. Internal limiting membrane removal in surgery for full-thickness macu-
lar holes. In: Madreperla SA, McCuen BW, eds. Macular Hole: Pathogenesis,
Diagnosis, and Treatment. Boston, Mass: Butterworth/Heinemann; 1998:125-
146.
15. Ryan EH, Gilbert HD. Results of surgical treatment of recent-onset full thickness
17. Smiddy WE, Pimentel S, Williams GA. Macular hole surgery without using ad-
18. Lansig MB, Glaser BM, Liss H, et al. The effect of pars plana vitrectomy and
transforming growth factor-β-1 without epiretinal membrane peeling on full-
Plasmin enzyme assisted vitrectomy in traumatic pediatric macular holes. Oph-
20. Banker AS, Freeman WR, Kim JW, Mungura D, Azen SP. Vision-threatening com-
plications of surgery for full-thickness macular holes. Ophthalmology. 1997;
104:1442-1453.
21. Park SS, Marcus DM, Duker JS, et al. Posterior segment complications after vi-

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