Visual Outcome After Laser Photocoagulation for Subfoveal Choroidal Neovascularization Secondary to Age-Related Macular Degeneration

The Influence of Initial Lesion Size and Initial Visual Acuity

Macular Photocoagulation Study Group

Objective: To provide detailed information specific to the initial visual acuity and initial lesion size on the outcome of patients with subfoveal choroidal neovascularization (CNV) secondary to age-related macular degeneration.

Design and Patients: The 189 eyes assigned to laser photocoagulation and the 184 eyes assigned to observation in the Subfoveal New CNV Study were divided into nine subgroups based on initial visual acuity and initial lesion size.

Main Outcome Measures: The pattern of visual acuity loss for both treated and untreated eyes through 4 years of follow-up was compared among the subgroups. Reading speed and contrast thresholds also were examined.

Results: Four patterns (A, B, C, D) of visual acuity loss in treated eyes relative to untreated eyes were identified. Eyes in group A (small lesion and moderate or poor initial visual acuity or medium lesion and poor visual acuity) had the best visual outcome with treatment; treated eyes were better throughout follow-up. Eyes in group B (small lesion and good initial visual acuity or medium lesion and moderate or good visual acuity) had substantial treatment benefit by 12 months, but were worse immediately after treatment. Eyes in group C (large lesion and poor initial visual acuity) had a small treatment benefit throughout follow-up. Eyes in group D (large lesion and moderate or good visual acuity) had the worst visual outcome with treatment; treated eyes were substantially worse for the first 18 months and were not appreciably better through 4 years of follow-up.

Conclusions: Recommendations for treatment of subfoveal CNV should take account of the initial visual acuity and lesion size. Eyes in group D are poor candidates for laser treatment.

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In previous reports, the Macular Photocoagulation Study (MPS) Group has summarized the results from the Subfoveal New Choroidal Neovascularization (CNV) Study, a randomized clinical trial of laser photocoagulation treatment for subfoveal CNV secondary to age-related macular degeneration.1,2 Eyes assigned to laser treatment initially lost more visual acuity than eyes assigned to no treatment; however, by 1 year after study entry, treated eyes had lost less visual acuity than untreated eyes and this treatment benefit persisted for at least 3 additional years. The results for reading speed were similar to the results for visual acuity. Contrast thresholds for eyes assigned to treatment remained at the level observed at study entry while thresholds for eyes assigned to no treatment deteriorated during follow-up.

During the design phase of the New CNV Study, two of the eligibility criteria were subjected to considerable debate because of preconceived ideas that laser treatment would not be beneficial for the treatment of subfoveal lesions with certain characteristics. The size of the lesion was restricted to smaller than 3.5 MPS disc areas1 because of concern that treatment of large lesions would leave too few perifoveal

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See Patients and Methods on next page
PATIENTS AND METHODS

The design and methods of the MPS have been described in detail in the MPS Manual of Procedures. Some of the methods also have been described in earlier articles.

PATIENT SELECTION AND FOLLOW-UP

Eligibility criteria for the New CNV Study included fluorescein angiographic documentation of a choroidal neovascular lesion having the following features: an area of classic CNV for which either the classic CNV itself or contiguous fibrovascular pigment epithelial detachment, a form of occult CNV, was under the center of the foveal avascular zone; clearly demarcated borders; and a combined area of classic CNV, fibrovascular pigment epithelial detachment, thick contiguous blood obscuring the border of CNV, elevated blocked fluorescence, and severe detachment of the retinal pigment epithelium of less than 3.5 MPS disc areas.

Best-corrected visual acuity in the study eye between 20/40 and 20/320 and age of 50 years or more also were required. Patients were enrolled in the study only after they had signed consent statements. Prior to random assignment of the study eye to laser treatment or no treatment, best-corrected visual acuity, reading speed, and contrast threshold of each eye were measured, and stereo fundus photographs of the macula and disc of each eye and stereo fluorescein angiograms were obtained. Eyes assigned to laser treatment were assigned randomly to either argon green or krypton red laser.

Visual acuity, reading speed, and contrast threshold were measured and stereo fundus photographs were taken at 3 and 6 months after enrollment and at 6-month intervals thereafter. Fluorescein angiography was performed at the 3-month examination and annually for all patients. Visual acuity was measured using Bailey-Lovie charts and standardized high illumination with no limitation on the amount of time needed to locate and identify the letters on the chart. A loss of 6 lines of visual acuity represents quadrupling of the minimum angle of resolution, e.g., a change from 20/80 to 20/320, Snellen equivalent. Reading speed was measured by recording the time required to read approximately 40 words of high-contrast text. At the required testing distance, the letter size corresponded to a visual acuity of approximately 20/1500. Contrast threshold was measured using an early version of the Pelli-Robson chart that had letter size corresponding to a visual acuity of approximately 20/725 at the required testing distance. Because the measurement of reading speed and testing of contrast threshold did not begin until 1987, approximately 18 months after initiation of enrollment, results from the baseline and early follow-up examinations are not available for approximately 40% of patients. All testing was performed on each eye with the contralateral eye occluded.

Color photographs and angiograms were reviewed by graders at the MPS Fundus Photograph Reading Center, Baltimore, Md. The composition, definition of borders, and size of the total lesion were among the features evaluated from the photographs taken at visits when fluorescein angiography was required.

Patient enrollment ended in December 1990. Data received by the MPS Coordinating Center through March 31, 1993, have been included in this report.

DATA ANALYSIS METHODS

Data for each eye have been analyzed with the group to which the eye was originally assigned at the time of randomization, including data for eyes that were classified as ineligible after randomization and a few eyes originally assigned to no treatment that later were treated. Differences between the group of patients assigned to laser treatment and the group of patients assigned to no treatment were analyzed using change in visual acuity as the primary outcome variable. The mean and median change in visual acuity, as well as the proportion of eyes with a decrease of 6 or more lines of visual acuity from baseline, were derived for each treatment group at each of the scheduled follow-up times and plotted against time. Estimates of the proportion of eyes with a decrease of 6 or more lines were calculated using a two-state stochastic model that accounts for both decreases and increases in visual acuity.

Differences in the effect of laser treatment on changes in visual acuity in subgroups of patients were evaluated through use of treatment-covariate interaction terms in linear regression models that included all important covariates identified previously (i.e., initial visual acuity, initial lesion size, age, fellow eye status, and amount of scarring in the lesion). Both continuous and categorical (three levels) representations of each of the two covariates of interest, initial lesion size and initial visual acuity, were evaluated in the regression models.

Visual acuity was categorized as good (≥20/100), moderate (20/125 to 20/160), or poor (≥20/200) and lesion size was categorized in MPS disc areas as small (≤1; Figure 1), medium (1 >1 and ≤2; Figure 2), or large (≥2; Figure 3). After establishing statistically significant treatment interactions in the anticipated direction for each of the two covariates at 3 months after study entry, treated and untreated eyes were compared within the nine subgroups formed by the three defined levels of initial lesion size combined with the three defined levels of initial visual acuity. Graphs of the proportion of eyes with 6 or more lines of decrease in visual acuity, the mean change in visual acuity, and the median change in visual acuity as described above were evaluated with regard to the difference in favor of no treatment at 3 months, the time at which the difference between treatment groups first favored treatment, and the magnitude of the difference in favor of treatment at 2 or more years after study entry. The nine subgroups were collapsed to four relatively homogeneous subgroups based on this evaluation.
The participants in the MPS Group as of March 31, 1993, are as follows.

Clinical Centers, Principal Investigators, Coinvestigators, and Clinic Coordinators

Emory Eye Center, Atlanta, Ga. Paul Sternberg, MD; Jayne M. Brown.
The Johns Hopkins University, The Wilmer Ophthalmological Institute, Baltimore, Md. Neil M. Bressler, MD; Susan B. Bressler, MD; Michael J. Elman, MD; Julia A. Haller, MD; Robert P. Murphy, MD; Andrew P. Schachat, MD; Peggy R. Orr, COMT; Katie Macmillan; Joann Starr.
Retina Associates of Cleveland (Ohio). Lawrence J. Singerman, MD; Thomas A. Rice, MD; Michael Novak, MD; Sheila Smith-Brewer, COT; Dina Preserens.
Texas Retina Associates, Dallas. Gary Edd Fish, MD; Bradley Jost, MD; Theresa Anderson.
Ingalls Memorial Hospital, Harvey and Chicago, Ill. David H. Orth, MD; Timothy P. Flood, MD; Kirk Packo, MD; Kathy Kwiatkowski.
Hermann Eye Center, Houston, Tex. Charles A. Garcia, MD; Michael A. Bloome, MD; Richard S. Ruiz, MD; Jim Matheny, MS.
University of Iowa, Iowa City. James C. Folk, MD; Alan E. Kimura, MD; Marcia Griffin.
University of Wisconsin, Madison. Suresh R. Chandra, MD; Frank L. Myers, MD; Thomas Stevens, MD; Betty Lewis.
University of Miami (Fla), Bascom Palmer Eye Institute. J. Donald M. Gass, MD; Mary Lou Lewis, MD; Elaine Chuang, MD; Ana Soler.
Medical College of Wisconsin, Milwaukee County Medical Complex. Gary W. Abrams, MD; Thomas Burton, MD; William F. Mieler, MD; Jan Laabs.
Touro Infirmary, New Orleans, La. Kurt Gitter, MD; Karen Schomaker.
University of Oklahoma, McGee Eye Institute, Oklahoma City. C. P. Wilkinson, MD.
Oregon Health Sciences University, Portland. Michael L. Klein, MD; Robert C. Watzke, MD; David J. Wilson, MD; Susan Nolte.
William Beaumont Hospital, Royal Oak, Mich. Raymond R. Margherio, MD; Patrick L. Murphy, MD; Mark Blumenkrantz, MD; Kristi Cumming, RN.
Retina Consultants Ltd, Washington University School of Medicine, St Louis, Mo. Dean B. Burgess, MD; Travis A. Meredith, MD; R. Joseph Olk, MD; Ann Wilder, RN, CRNO.

Study Chairman’s Office

University of Pennsylvania, Scheie Eye Institute, Philadelphia. Stuart L. Fine, MD; Virginia Nido.

Coordinating Center

The Johns Hopkins University, The Wilmer Ophthalmological Institute. Principal Investigator: Barbara S. Hawkins, PhD; Study Statistician: Maureen G. Maguire, PhD; George T. Allen; Rosemary Alluisi; Irene L. Goldsborough; Joan L. Jefferys, ScM; Jean A. Keller, MS; Marta J. Marsh, MS; Lee McCaffrey, MA; Anita Miller-Hart; M. Marvin Newhouse; Vision Testing Consultant: Gary S. Rubin, PhD.

Fundus Photograph Reading Center

The Johns Hopkins University, The Wilmer Ophthalmological Institute. Principal Investigator: Neil M. Bressler, MD; Director: Judith Alexander; Susan B. Bressler, MD; Rochelle Eure-Coooper; Cheryl J. Hiner; Noreen B. Javornik, MS; Deborah A. Phillips; Yan Tian; Gregory Whitehead.

National Eye Institute

National Institutes of Health, Bethesda, Md. Jack A. McLaughlin, PhD.

Executive Committee

Study Chairman: Stuart L. Fine, MD; Judith Alexander; Neil M. Bressler, MD; Dean B. Burgess, MD; Gary Edd Fish, MD; James C. Folk, MD; Barbara S. Hawkins, PhD; Mary Lou Lewis, MD; Maureen G. Maguire, PhD; Lee McCaffrey, MA; Jack A. McLaughlin, PhD; Susan Nolte; Patrick J. Saine, MEd; Paul Sternberg, MD; Robert C. Watzke, MD; Ann Wilder, RN, CRNO.

Data and Safety Monitoring Committee

Voting Members: Chairman: Curtis L. Meinert, PhD; Patricia McCormick Beamer; Argye I. Hillis, PhD; Lee M. Jampol, MD; Edward B. McLean, MD; Bernard Rosner, PhD; Barbara Safriet, LLM, JD. Nonvoting Members: Stuart L. Fine, MD; Barbara S. Hawkins, PhD; Maureen G. Maguire, PhD; Jack A. McLaughlin, PhD; M. Marvin Newhouse.

Clinic Monitoring Committee

Chairman: Lee McCaffrey, MA; Judith Alexander; Stuart L. Fine, MD (ex officio); Robert Harrison; Barbara S. Hawkins, PhD; Maureen G. Maguire, PhD; Anita H. Miller-Hart; Peggy R. Orr, COMT; Ann Wilder, RN, CRNO.
photoreceptors to allow useful vision. The initial visual acuity originally was restricted to 20/80 or worse, with randomization schedules stratified on initial visual acuity, because of concern that laser treatment of eyes with good visual acuity would cause immediate destruction of the photoreceptors that were providing the good vision. After approximately two thirds of the 373 patients had been enrolled, the limit was changed to 20/40 or worse because the investigators were more comfortable treating eyes with such good visual acuity after they had additional experience with both treated and untreated eyes with subfoveal CNV.

See also pages 459, 462, 489, and 500

However, the concerns during the design phase proved to be justified. The advantage of treatment over no treatment was apparent earlier and to a greater degree in eyes with smaller lesions at baseline and in eyes with worse initial visual acuity. While this information has proven useful in discussing strategies for managing patients with newly diagnosed subfoveal CNV, additional questions have been raised concerning the visual outcome for eyes with various combinations of initial acuity and lesion size, such as eyes with small lesions and relatively good visual acuity. In addition, delaying treatment, especially in eyes with relatively good visual acuity, has been suggested as alternative management. The objective of this report is to provide more information on the outcomes of subgroups of patients with different combinations of lesion size and initial visual acuity and to describe the clinical course after diagnosis of subfoveal CNV for untreated eyes that had good initial visual acuity.

RESULTS

A total of 371 patients (373 eyes) were enrolled in the New CNV Study; 189 eyes (51%) were assigned randomly to laser photocoagulation and 184 eyes (49%) were assigned to observation. Fifty-seven (15%) of the patients died during the follow-up period. The median length of follow-up was 48 months. Nine percent of the 3373 scheduled follow-up examinations were missed. Five (3%) of the 184 eyes assigned to no treatment received laser photocoagulation during the follow-up period; four of these eyes were treated after the December 1990 change in protocol recommendation by the MPS Data and Safety Monitoring Committee that laser treatment be offered to patients with an eye meeting the eligibility criteria for the New CNV Study.

PATTERNS OF VISUAL ACUITY CHANGE DURING FOLLOW-UP

Estimates of the effects of initial visual acuity and initial size of lesions on the difference in change in visual acuity at 3 months from baseline between treated and untreated eyes were obtained by fitting linear regression models. Treated eyes had increasingly worse visual acuity changes relative to untreated eyes with larger lesion size ($P<.0001$) and with better initial visual acuity ($P<.0001$). These same relationships were maintained when initial lesion size and visual acuity were represented as categorical variables ($P=.001$ and $P=.002$, respectively). Thus, subdivision of the 373 eyes into subgroups based on initial visual acuity and lesion size to evaluate subgroup-specific treatment effects was deemed justified.

The number of patients in each of the nine sub-
groups formed by cross-classifying the three initial visual acuity categories with the three initial lesion size categories ranged from 21 to 62 (Table 1). One patient had a poorly demarcated lesion that prevented classification by size, and data for this patient are not included in Table 1. Patients with small lesions but poor visual acuity and patients with large lesions but good visual acuity were less common than patients with the other combinations of lesion size and visual acuity.

Inspection of the proportion of eyes with 6 or more lines of decrease in visual acuity, the mean change in visual acuity, and the median change in visual acuity for both the treated group of eyes and the untreated group of eyes revealed four distinct patterns of visual acuity loss. These patterns were labeled A through D.

Pattern A was characterized by loss of visual acuity in treated eyes than in untreated eyes at every examination during follow-up. Three of the subgroups consisting of the 103 study eyes (28%) with lesions smaller than or equal to 1 MPS disc area and visual acuity of 20/125 or worse or with lesions larger than 1 but smaller than or equal to 2 MPS disc areas and visual acuity of 20/200 or worse followed pattern A (Figure 4). The proportion of eyes in group A with 6 or more lines of decrease in visual acuity for treated eyes and for untreated eyes is shown in Figure 5. At 3 months, no treated eyes had lost 6 or more lines of visual acuity compared with 14% of untreated eyes. After 3 months and through 4 years, substantially more untreated eyes than treated eyes had such a large decrease in visual acuity.

Pattern B was characterized by more loss of visual acuity in treated eyes than in untreated eyes at 3 months but less loss of visual acuity in treated eyes than untreated eyes at 12 months and thereafter (Figure 6). Three of the subgroups consisting of the 145 study eyes (39%) with lesions smaller than or equal to 1 MPS disc area and visual acuity of 20/100 or better or with lesions larger than 1 but smaller than or equal to 2 MPS disc areas and visual acuity of 20/160 or better followed pattern B (Figure 4). It should be noted that even though three subgroups followed pattern B, the difference in change in visual acuity at 3 months between treated and untreated eyes was not the same in all three subgroups. At 3 months
alter study entry, in the subgroup with good initial visual acuity and medium lesions, the mean change in treated eyes was −5.7 lines vs −2.5 lines for untreated eyes; in the subgroup with good initial visual acuity and small lesions, the mean change was −3.9 lines for treated eyes vs −3.2 lines for untreated eyes; and in the subgroup with moderate visual acuity and medium lesions, the mean change was −2.1 lines for treated eyes vs −1.5 lines for untreated eyes.

Pattern C was characterized by relatively low proportions of large decreases in visual acuity in both treated and untreated eyes and by slightly less loss of visual acuity in treated eyes during follow-up (Figure 7). The subgroup of eyes that had lesions larger than 2 MPS disc areas and visual acuity of 20/200 or worse, consisting of 62 study eyes (17%), followed pattern C (Figure 4). Although the proportion of eyes with 6 or more lines of decrease in visual acuity was lower at all times for treated eyes, the difference between treated and untreated eyes was as small as 1% or 2% at a few of the examination times.

Pattern D was characterized by substantially more visual acuity loss in treated eyes than in untreated eyes at 3 months through 18 months and little difference between the two treatment groups thereafter (Figure 8).

Two of the subgroups consisting of the 62 study eyes (17%) with lesions larger than 2 MPS disc areas and visual acuity of 20/160 or better followed pattern D (Figure 4).

In all nine subgroups, the visual acuity of treated eyes remained relatively stable after the initial decrease between study entry and 3 months (Figures 5 through 8). Untreated eyes continued to lose visual acuity after 3 months. Reading speed patterns for treated and untreated eyes were similar to the patterns observed for visual acuity. Contrast thresholds remained relatively stable at baseline levels for treated eyes, while they deteriorated for untreated eyes in all subgroups (Table 2).

**COURSE OF UNTREATED EYES**

Although eyes with good visual acuity and small or medium lesions, a subset of group B, had a long-term advantage with laser treatment, the immediate loss with laser treatment of approximately 6 lines of visual acuity for patients with medium lesions and 4 lines for patients with small lesions is not appealing to many patients and ophthalmologists. Delaying treatment until vision decreases and the immediate excess loss of visual acuity associated with treatment is minimized.
(group A) has been suggested as an alternative to immediate treatment.

Table 3 shows that by 3 months, visual acuity had decreased to worse than 20/100 for more than half of these eyes. However, almost all (96%) of the small lesions and most (81%) of the medium lesions also had increased in area. Only two (8%) of the eyes with initially small lesions and one (4%) of the eyes with initially medium lesions could be classified in group A at 3 months. Of note, 10 (42%) of the untreated eyes with small lesions and nine (33%) of the untreated eyes with medium lesions maintained visual acuity of 20/100 or better; the corresponding results were six (27%) of 22 and one (5%) of 21, respectively, for treated eyes. The majority of eyes had lesion growth and further visual acuity loss to the extent that by the 3-month examination, they were either no longer eligible for treatment or belonged to group D with a less favorable prognosis with treatment.

By 12 months, approximately 20% of the untreated eyes in the subset of group B that started with good visual acuity had maintained good visual acuity, while 52% of eyes with small lesions and 38% of eyes with medium lesions had lost visual acuity to the level of 20/400 or worse (Table 4). Only one (5%) of the 22 treated eyes with an initially small lesion had maintained visual acuity of 20/100 or better at 12 months. Most of the untreated lesions had become larger than 3.5 MPS disc areas and only approximately 10% of eyes were still eligible for treatment. By 36 months, seven (16%) of the 43 untreated eyes followed up still had visual acuity of 20/100 or better.

It is possible that untreated eyes with large lesions and visual acuity of 20/160 or better (group D) could evolve to have large lesions and visual acuity of 20/200 or worse (group C). Among the 21 untreated eyes in group D observed at 3 months, nine (43%) retained visual acuity of 20/160 or better but had lesions that were larger than 3.5 MPS disc areas and/or poorly defined. All 12 remaining eyes (57%) had visual acuity of 20/200 or worse at 3 months; however, only one eye had a lesion smaller than or equal to 3.5 MPS disc areas that would qualify for group C.

### Table 2. Median Contrast Threshold by Pattern, Treatment Group, and Time

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Group</th>
<th>No. of Eyes</th>
<th>Percent Contrast</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td>A</td>
<td>Untreated</td>
<td>28</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Treated</td>
<td>34</td>
<td>14</td>
</tr>
<tr>
<td>B</td>
<td>Untreated</td>
<td>50</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Treated</td>
<td>39</td>
<td>14</td>
</tr>
<tr>
<td>C</td>
<td>Untreated</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Treated</td>
<td>18</td>
<td>28</td>
</tr>
<tr>
<td>D</td>
<td>Untreated</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Treated</td>
<td>24</td>
<td>14</td>
</tr>
<tr>
<td>All</td>
<td>Untreated</td>
<td>108</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Treated</td>
<td>119</td>
<td>14</td>
</tr>
</tbody>
</table>

*See text for description of patterns.
†Minimum sample size among the four observation times.

 COMMENT

Earlier reports by the MPS Group on the New CNV Study of photocoagulation of subfoveal choroidal neovascular lesions secondary to age-related macular degeneration described the short-term and long-term effects of treatment relative to no treatment.12 The reports also noted that the advantage of treatment over no treatment was apparent earlier and to a greater degree in eyes with initially smaller lesions and in eyes with initially worse visual acuity. However, the clinical course of eyes having one feature associated with an increased treatment benefit, eg, smaller lesion size, and another feature associated with a decreased treatment benefit, eg, good visual acuity, was not clear. The results contained in this report extend the description of treatment effect to particular subgroups of interest that were not specifically addressed previously. It should be noted that the effects of treatment of recurrent subfoveal lesions in the Recurrent CNV Study did not appear to be affected by initial lesion size or visual acuity.2

In treated eyes, there was relatively little change in visual acuity after the initial loss observed between baseline and 3 months in all four patterns identified. However, untreated eyes generally continued to lose visual acuity through at least 24 months. The difference between the treated and untreated eyes at 3 months and the magnitude of the additional loss of visual acuity distinguished the patterns.

As anticipated from the previous reports in the New CNV Study, eyes with both small lesions and poor visual acuity belonged to the group (group A) having the best overall treatment benefit, and eyes with large lesions and good visual acuity belonged to the group (group D) having little or no treatment benefit. The pattern of visual acuity loss of eyes with other combinations of visual acuity and lesion size was less predictable. For example, eyes with medium lesions and good visual acuity followed pattern B, with a treatment benefit by 12 months, while eyes with large lesions and moderate visual acuity followed pattern D, with no sizeable treatment benefit through 48 months.

When classifying eyes with subfoveal CNV in clinical practice, it is important to remember that the visual acuity for patients in the MPS was measured using high illumination on high-contrast charts; measurement of the visual acuity of the same eyes under less ideal conditions might have resulted in visual acuities of 1 to 2 lines worse than those used in this report.

It should be noted that in all subgroups, treated eyes maintained the baseline level of contrast threshold but untreated eyes deteriorated during follow-up. While the ex-
Table 3. Status at 3 Months After Study Entry of Untreated Eyes With Small or Medium Lesions and Initial Visual Acuity of 20/100 or Better*

<table>
<thead>
<tr>
<th>Lesion Size at Study Entry, MPS Disc Areas</th>
<th>Small (≤1)</th>
<th>Medium (&gt;1 to ≤2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status at 3 mo</td>
<td>(n=24)</td>
<td>(n=27)</td>
</tr>
<tr>
<td>Visual acuity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥20/100</td>
<td>10 (42)</td>
<td>9 (33)</td>
</tr>
<tr>
<td>20/125-20/160</td>
<td>4 (17)</td>
<td>7 (26)</td>
</tr>
<tr>
<td>20/200-20/320</td>
<td>6 (25)</td>
<td>8 (30)</td>
</tr>
<tr>
<td>≤20/400</td>
<td>4 (17)</td>
<td>3 (11)</td>
</tr>
<tr>
<td>Lesion size, MPS disc areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤1</td>
<td>1 (4)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>&gt;1 to ≤2</td>
<td>8 (35)</td>
<td>5 (19)</td>
</tr>
<tr>
<td>&gt;2 to ≤3.5</td>
<td>10 (43)</td>
<td>10 (38)</td>
</tr>
<tr>
<td>&gt;3.5</td>
<td>4 (17)</td>
<td>11 (42)</td>
</tr>
<tr>
<td>Lesion borders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Well defined</td>
<td>21 (88)</td>
<td>21 (84)</td>
</tr>
<tr>
<td>Poorly defined in part</td>
<td>3 (12)</td>
<td>3 (12)</td>
</tr>
<tr>
<td>Scar only</td>
<td>0 (0)</td>
<td>1 (4)</td>
</tr>
<tr>
<td>Pattern of visual acuity change†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>2 (8)</td>
<td>1 (4)</td>
</tr>
<tr>
<td>B</td>
<td>6 (25)</td>
<td>2 (8)</td>
</tr>
<tr>
<td>C</td>
<td>2 (8)</td>
<td>4 (15)</td>
</tr>
<tr>
<td>D</td>
<td>6 (25)</td>
<td>5 (19)</td>
</tr>
<tr>
<td>No longer eligible for treatment</td>
<td>8 (33)</td>
<td>14 (54)</td>
</tr>
</tbody>
</table>

*Data are number (percent) of eyes. MPS indicates Macular Photocoagulation Study. Numbers may not sum to totals for some characteristics because of missing data.
†See text for description of patterns.

act trade-off in function between contrast sensitivity and visual acuity is not known, it is known that better contrast thresholds are associated with improved performance of selected daily tasks independent of visual acuity. Therefore, the benefit of better contrast thresholds with treatment should be considered in deciding whether to treat eyes with eligible lesions and may be especially critical for patients whose eyes belong to group C, in which there is only a small treatment benefit in visual acuity (Figure 6).

The decision on management of eyes in group B with good visual acuity and lesions smaller than or equal to 2 MPS disc areas is difficult. Treatment typically results in a mean loss of 4 lines of visual acuity in eyes with small lesions and a mean loss of 6 lines for eyes with medium lesions. At first glance, withholding treatment with the hope that the patient will be among the 20% who maintain good visual acuity throughout at least 1 year is appealing; however, at this time, there is no way of predicting which patients will remain in stable condition and which patients will suffer further severe visual acuity loss (Tables 3 and 4). Most untreated eyes will have further vision growth and will lose substantial visual acuity, often to the extent that treatment may not benefit the patient. Review of the baseline photographs and angiograms of all patients with good visual acuity has failed to identify any feature predictive of stable, good visual acuity. The eccentricity of the lesion at baseline relative to the foveal center was also examined; however, this aspect of the lesion was no more informative about subsequent visual acuity than the combination of initial visual acuity and lesion size.

The information presented in this report should be of assistance to the ophthalmologist and patient in deciding on the most appropriate management. Eyes in group A (small lesions and visual acuity of 20/125 or worse or medium lesions and visual acuity of 20/200 or worse) are very good candidates for treatment. Treated eyes in group A have less loss of visual acuity than untreated eyes as soon as 3 months after treatment and at all times thereafter (Figure 5). There appears to be little reason not to treat these eyes on presentation.

Eyes in group B (small lesions and visual acuity of 20/100 or better or medium lesions and visual acuity of 20/160 or better) have a substantial treatment benefit beginning 1 year after treatment and are good candidates for immediate treatment (Figure 6). However, for a patient with a small lesion and visual acuity of 20/50, nei-
ther the patient nor the ophthalmologist may be psychologically prepared for the immediate loss of visual acuity that follows laser treatment. Accordingly, after a detailed review of the outcome data with the patient, it may be appropriate to follow up the patient at frequent intervals with visual acuity measurements and fluorescein angiography. When the visual acuity begins to deteriorate, the patient may accept further loss of vision as inevitable and choose treatment. Alternatively, when the lesion shows growth on the fluorescein angiogram, even in the absence of reduced visual acuity, a rather rare circumstance, laser treatment may be more acceptable. Whenever close follow-up is chosen, it must be recognized that there is still a chance that the lesion will enlarge between examinations and the opportunity to improve on the natural course will be lost.

Eyes in group C (large lesions and visual acuity of 20/200 or worse) have already lost substantial visual acuity and have a relatively low chance of further large loss whether treated or not (Figure 7). However, treated eyes have less risk of severe visual acuity loss throughout follow-up and have better contrast thresholds than untreated eyes. Eyes in group C should be considered good candidates for treatment since the risk of further loss with treatment is low and there is a small treatment benefit.

Eyes in group D (large lesions and visual acuity of 20/160 or better) lose much more visual acuity with treatment than without treatment to the extent that the natural course of visual acuity loss in untreated eyes does not reach the level of the loss in treated eyes until 2 years after treatment (Figure 8). There is no appreciable treatment benefit in visual acuity through 4 years. Although contrast thresholds are better for treated eyes than for untreated eyes throughout follow-up (Table 2), this benefit is outweighed by the nearly immediate loss of 6 lines of visual acuity by nearly half the eyes receiving laser treatment (Figure 8). Eyes in group D are poor candidates for treatment. Follow-up of these patients may be worthwhile since it is possible that they may lose additional visual acuity without substantial growth of the lesion. Under such circumstances, they would fall into group C and could be considered again for treatment. However, only one (5%) of 21 untreated eyes in group D was actually reclassified into group C at 3 months. More frequent examinations in the period immediately following presentation may have captured additional eyes with visual acuity loss to 20/200 or worse before the lesion exceeded 3.5 MPS disc areas.

Although management of subfoveal CNV secondary to age-related macular degeneration must be individualized for each patient, the data presented herein should be of substantial benefit to ophthalmologists and patients in making treatment decisions.

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Transparency copies of the MPS Disc Area circles for Zeiss 30° photographs are available from the Wilmer Reading Center, 550 N Broadway, Ninth Floor, Baltimore, MD 21205 for a charge of $2.50 each.

Reprints requests to the Macular Photocoagulation Study Coordinating Center, 550 N Broadway, Ninth Floor, Baltimore, MD 21205 (Dr Maguire).

REFERENCES