Availability of Color Fundus Photographs From Previous Visit Affects Practice Patterns for Patients With Diabetes Mellitus

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Objective: To determine whether access to color fundus photographs from a patient's previous visit would alter the recommendations rendered to a cohort with diabetic retinopathy.

Patients and Methods: One hundred sixty patients with diabetic retinopathy returning for a follow-up visit and who had color fundus photographs obtained at a previous visit were evaluated by trained retina specialists. Their clinical impression and recommendations regarding management of diabetic retinopathy were recorded without reference to previous photographs. Color fundus photographs from the patient's most recent visit were then reviewed and new recommendations with regard to appropriate treatment and follow-up were recorded.

Results: In 21% of cases, after reviewing the patient's most recent color fundus photographs, the clinical recommendation changed. In 14% of cases, photographs clearly demonstrated that the patient's condition was stable or improved, resulting in a change from recommending treatment to recommending deferral of treatment. In 4% of cases, photographs clearly demonstrated clinical worsening and the recommendation was changed from observation to treatment. In 3% of cases, review of photographs prompted a change in the recommended follow-up interval.

Conclusion: Access to color fundus photographs from a patient's previous visit frequently changed the clinical recommendations made to patients with diabetic retinopathy regarding appropriate treatment and follow-up. Availability of color fundus photographs therefore has implications about quality of care and may affect the cost of care.


Diabetic retinopathy is a major public health issue in the United States and is the leading cause of potential blindness among Americans aged 20 to 74 years. More than 50,000 new cases of proliferative retinopathy and macular edema occur each year.1,2 Appropriate, cost-effective treatment is vital. Clinical trials have demonstrated the effectiveness of laser photocoagulation in the treatment of diabetes-related macular edema3 and proliferative retinopathy.4,5 Reports from the Diabetic Retinopathy Study (DRS) and Early Treatment Diabetic Retinopathy Study (ETDRS) have established guidelines that may be used to determine the proper timing for intervention with laser photocoagulation.3,6 Specifically, scatter laser photocoagulation should be considered as a patient approaches or develops high-risk proliferative diabetic retinopathy (PDR). Similarly, focal laser photocoagulation should be considered as a patient approaches or develops clinically significant macular edema (CSME). Other factors, such as patient preference, ease and likelihood of follow-up, rapidly progressive disease, or long-term stability of disease, may play a role in the initiation or delay of treatment.6

It is important to assess the status of a patient's retinopathy at a single clinical visit, but it is also important to place the clinical findings within the context of the patient's disease progression and response to previous therapy. One method for determining whether a patient's retinopathy is progressing, improving, or stable is to use sequential color fundus stereoscopic photographs to accompany sequential clinical examinations with careful retinal drawings. In the current health care environment, however, it may be necessary to demonstrate to patients and third-party payers that the use of ancillary testing, such as color fundus photography, is appropriate, cost-effective, and necessary. In a previous study evaluating fluorescein angiography for the detection of recurrent choroidal neovascularization following laser treatment,7 we reported that 12% of recurrences would have been missed (most of which were judged to likely benefit from additional laser photocoagulation) had angiography not been performed and the clinical examination alone been relied on. In our opinion, the benefit of obtaining posttreatment angiograms, at least through 1 year following laser treatment, outweighed the relatively low medical risk and cost.
PATIENTS AND METHODS

One hundred eighty consecutive returning patients with diabetic retinopathy who had previously had fundus photography performed at the Retinal Vascular Center, Wilmer Ophthalmological Institute, Baltimore, Md, were examined from August 31, 1994, through November 3, 1994. Exclusion criteria included patients with duplicate visits during the study period. Only the first visit during the study period was included for patients who had more than 1 visit during the study period (6 patients); patients whose photographs from the previous visit were not available (4 patients) and patients with diabetes whose reason for the clinical visit was a primary diagnosis other than diabetic retinopathy (10 patients) were also excluded. One hundred sixty patients were enrolled in the study.

Photographs used were from the patient’s most recent visit at which photographs were obtained. The protocol at the Retinal Vascular Center is to obtain 35-mm stereo 30° photographs of the optic disc and macula (standard fields 1 and 2) for patients with CSME and standard 7-field fundus photographs for patients at risk for or on the development of PDR. Therefore, previous stereo disc and macula photographs were evaluated for patients with CSME, and 7-field fundus photographs were evaluated for patients with PDR. Patients without macular edema or only mild nonproliferative diabetic retinopathy are generally not photographed.

During the study period, patients were examined initially without reference to any old photographs. Recommendations were recorded with regard to treatment and scheduling of follow-up at the study visit there had been clinical worsening and the interval for the next follow-up appointment should be shortened, and 4 patients were advised to have laser treatment (27 for CSME and 18 for PDR).

In this current study of patients with diabetic retinopathy, we were interested in how often access to color fundus photographs from a patient’s previous visit would change our treatment or follow-up recommendations.

Table 1. Demographics of Study Population (N = 160)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total Sample</th>
<th>No Change</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age, y (range)</td>
<td>59 (21-91)</td>
<td>57.5</td>
<td>60.4</td>
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<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>96 (60)</td>
<td>53 (42)</td>
<td>11 (33)</td>
</tr>
<tr>
<td>M</td>
<td>64 (40)</td>
<td>73 (58)</td>
<td>23 (67)</td>
</tr>
<tr>
<td>Mean duration of diabetes, mo (range)</td>
<td>228 (18-576)</td>
<td>237.9</td>
<td>201.4</td>
</tr>
<tr>
<td>Type 1 diabetes</td>
<td>39 (24)</td>
<td>33 (26)</td>
<td>6 (18)</td>
</tr>
<tr>
<td>Type 2 diabetes</td>
<td>121 (76)</td>
<td>93 (74)</td>
<td>28 (82)</td>
</tr>
<tr>
<td>Taking insulin at study visit</td>
<td>122 (76)</td>
<td>94 (75)</td>
<td>28 (82)</td>
</tr>
<tr>
<td>Mean age of photographs, mo</td>
<td>6.3</td>
<td>6.7</td>
<td>4.8</td>
</tr>
</tbody>
</table>

*All data are presented as number (percentage) unless otherwise indicated.

RESULTS

Table 1 describes the patient characteristics. No statistically significant difference was seen between the change and no change groups during the study visit on the basis of clinical diagnosis (CSME vs PDR), age of the patient, sex, duration of diabetes, insulin dependence, type 1 vs type 2 diabetes, age of photographs used from the last clinical visit, and examining physician.

On the basis of clinical examination alone, 100 patients would have been advised that no treatment was necessary at the study visit and 60 patients would have been advised to have laser photocoagulation (40 patients for CSME and 20 patients for PDR). However, after having an opportunity to review color fundus photographs from the patient’s previous visit and compare them with the current clinical examination results, recommendations for 34 patients were changed (Table 2). Following review of the photographs, 110 patients were advised that no treatment was necessary at the study visit, 5 patients were advised that although they did not require treatment at the study visit there had been clinical worsening and the interval for the next follow-up appointment should be shortened, and 45 patients were advised to have laser treatment (27 for CSME and 18 for PDR).

In 34 (21%) of the 160 patients included in the study, our recommendations changed after having the opportunity to evaluate the previous visits’ stereo fundus photographs (Table 2). Twenty-six (76%) of these changes involved recommendations for management of CSME and 8 (24%) involved recommendations for management of PDR. Eighteen patients who would have been advised to have laser treatment for CSME and 4 patients who would have been advised to have laser treatment for PDR based on clinical examination alone were advised to defer treatment after review of the previous visit’s photographs. Conversely, 5 patients who would have had observation only for CSME and 2 patients who would have had observation only for PDR were advised to proceed with laser treatment after review of the photographs. In addition, 5 patients (3 with CSME and 2 with PDR) were judged to be worse clinically after review of their previous photographs, but not sufficiently so as to warrant immediate treatment. They were advised to return for follow-up sooner than they otherwise would have. After reviewing the photographs, no patient was advised to return for follow-up later than was planned prior to reviewing the photo-
In all, 14% of the 160 study patients had their recommendation change from treatment to no treatment, 4% were changed from no treatment to treatment, and 4% had their follow-up interval shortened.

**COMMENT**

The DRS and ETDRS have published management recommendations for the treatment of PDR and CSME and recommendations have been summarized in various guidelines such as the American Academy of Ophthalmology Preferred Practice Patterns. These studies have demonstrated the efficacy of scatter laser photocoagulation in patients with high-risk PDR and focal laser photocoagulation in patients with CSME. In clinical practice, other factors such as patient preference or rapidity of progression vs long-term stability affect the recommendations we offer to patients. Although we generally advise treatment when CSME or high-risk PDR is present, we may modify our recommendations based on an individual patient's clinical course. For example, if a patient with CSME was treated at the last visit and still has CSME at a follow-up visit several months later, but the CSME has clearly improved, we may defer treatment, planning additional photocoagulation if the improvement does not continue. Similarly, if following completion of panretinal photocoagulation for PDR there is still some residual neovascularization, but overall there has been regression of neovascularization, we may defer further treatment until new retinal neovascularization occurs. The reverse is also true. A patient with borderline CSME who has definitely worsened with edema progressing toward the fovea since the previous visit may receive a recommendation to begin treatment.

Fundus photography may be the most accurate way to document the clinical status of a patient at a given point in time and we believe, although it is not proven in this study, that we can make judgments more reliably about retinopathy progression by comparing the clinical examination results with good-quality stereo photographs rather than with memory, written clinical descriptions, or hand-drawn sketches without photography. We believe that following up a patient with sequential fundus photography
in addition to ophthalmoscopy and careful sketches is an effective way of determining subtle trends in a patient’s condition. However, as the health care environment evolves, we must be prepared to justify the use of ancillary testing such as fundus photography in terms of tangible benefits to the patient in relation to the cost of such tests. We evaluated whether having fundus photographs from the patient’s most recent visit changed our recommendations to the patient about treatment for PDR or CSME, as well as timing of follow-up visits. We did not evaluate whether our changed management recommendations yielded a better or worse clinical outcome. This would have required randomization to management with or without photographs and several years of follow-up, which was beyond the scope of the current study.

Having a patient’s previous fundus photographs available to us at the clinical visit permits us to evaluate the patient’s current status in relation to clinical course. Fifteen patients’ conditions were clearly improved when examination results were compared with their previous photographs and 7 patients’ conditions were unchanged (Table 2). Without reference to previous photographs, we would have recommended laser treatment for these patients; however, with photographic proof of stability or improvement, treatment was deferred. Twelve patients’ conditions were clearly worse when examination results were compared with their previous photographs (Table 2). Based on the clinical examination alone, we would have recommended standard observation; however, with photographic proof of worsening, 7 patients were advised to proceed with laser treatment and 5 were advised to return for follow-up at a shorter interval than had originally been proposed. Interestingly, although 30° stereo disc and macula photographs or 7-field fundus photographs were reviewed in this study, all changes in recommendation were made on the basis of the disc and macula photographs. In none of the patients was a change in recommendation prompted by any photographs outside of the fields of the disc and macula.

The frequency of altered recommendations was similar regardless of patient age, sex, type 1 or 2 diabetes, insulin dependence, age of photographs, or the examining physician. We do not know if evaluating a larger number of patients would have detected differences in these subgroups.

Overall, after reviewing the previous visit’s photographs, our recommendations to the patient would have changed in 34 patient visits (21%). In the majority of cases (22 visits), this represented a change from a decision to treat the patient to a recommendation for deferral of treatment. In 7 cases, the change was from not treating to treating a patient. In 5 cases the change involved decreasing the interval of follow-up visits.

We conclude that being able to refer to our patients’ previous fundus photographs allows us more accurately to assess the progression or regression of retinopathy and therefore to recommend more appropriate treatment. Following review of the patient’s previous fundus photographs there was a net decrease of 15 recommendations for laser treatment. Given the much higher charge for laser treatment vs that for photographs, obtaining fundus photographs and referring to them before deciding on whether to advise treatment may result in better clinical management and actually be a net cost savings to patients and payers (at least for the short term). It remains possible that we may simply be delaying treatment and that ultimately the cost of treatment will be incurred. However, it is likely that at least some of the patients will have avoided treatment and, moreover, there is a monetary value in delaying incurring an expense (the “time value” of money). A detailed economic analysis is beyond the scope of this article. Our goal was simply to determine whether the availability of color fundus photographs from a previous visit affects our recommendations to our patients with diabetic retinopathy—and it does.

Our practice is not a typical ophthalmology practice, nor is it a typical retina practice. Only “medical retina” patients are seen at the Retinal Vascular Center. Most of our patients with diabetes are referred with significant disease and therefore we see relatively few patients with minimal grades of retinopathy. For these reasons, results from other clinical practices may differ somewhat from ours in terms of case-mix, patient demographics, and interpretation of clinical and photographic data. If we had not had access to photographs from the previous visit, we would have advised patients differently in 21% of visits and the total cost of the visits, photographs, and treatment might have been greater.

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REFERENCES