Causes of Preventable Visual Loss in Type 2 Diabetes Mellitus

An Evaluation of Suboptimally Timed Retinal Photocoagulation

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To examine circumstances surrounding suboptimally timed retinal photocoagulation, we reviewed the medical records of 238 patients who had received photocoagulation for diabetic retinopathy at one of three large referral centers. Forty-three percent (95% confidence interval, 36% to 49%) of cases were rated as probably or definitely suboptimally timed (i.e., patient could have benefited from earlier photocoagulation). About one third of cases were due to patients going many years without screening (> 3 years), and two thirds were associated with surveillance problems (failures to achieve close follow-up for known retinopathy). We found that suboptimal timing of photocoagulation was common but was not due to patients going between 13 and 36 months between screening visits, suggesting that current performance measures, which focus on annual retinal examinations, may be requiring wasteful care while not addressing a major quality problem.

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Retinal photocoagulation for diabetic retinopathy is one of the most effective treatments in modern medicine, reducing the risk of moderate to severe vision loss by 50% to 90%.[1–3] However, optimal results typically require that treatment be given before the onset of visual symptoms. In an attempt to improve visual outcomes in people with diabetes, in the 1980s organizations and experts began to advocate that all people with diabetes receive annual dilated retinal examinations. This recommendation also became a common quality measure for health plans, and consequently, health care systems devote great effort and expense in trying to achieve or maintain high annual eye screening rates, often without success.[4–8]

However, setting the interval for routine screening examinations as annual was speculative at best, and in 2000, Vijan et al. questioned whether *annual* screening should be the standard of care.[9] Their results, which used probability modeling and the best available epidemiological evidence, suggested that annual screening (routine examinations for those whose last retinal examination had been normal) produced only trivial benefits over screening every 2 to 3 years. In contrast, their results suggested that the interval for surveillance (follow-up of patients with known retinopathy) was likely to be much more critically important.[9] Recently, two large prospective, longitudinal studies have provided strong supportive evidence for these conclusions, reporting that the incidence of vision-threatening retinopathy occurring within 3 years is extremely low if the previous retinal examination was normal.[10–12] Although these results are consistent with the findings of Vijan et al., some experts have continued to recommend caution in extrapolating these results to clinical practice.[11,13]

Another approach to exploring this issue is to evaluate the circumstances surrounding suboptimally timed photocoagulation. If annual screening is important, then we should see adverse consequences occurring when patients go 2 to 3 years without screening (intervals that are very common in most health care systems).[6] In contrast, if we do not see preventable complications occurring in such patients, then efforts to promote annual screening may be misplaced. Afterall, annual retinal screening is only a surrogate quality measure. The reduction of preventable vision loss through optimally timed retinal laser therapy is the true indicator of adequate quality. Therefore, we examined the proportion of patients who had suboptimally timed photocoagulation and the circumstances surrounding these quality failures.

METHODS

Medical records were reviewed at three large referral centers: one university ophthalmologic center and two urban Veterans Affairs medical centers (VAMC). Physician reviewers examined the records of patients who had received initial photocoagulation for either proliferative diabetic retinopathy or macular edema. The study included 99 consecutive eligible patients who received treatment at the university site in 1997–1999, 23 patients in 2000 at one VAMC, and 116 patients treated in 1996–1999 at the other VAMC.

The medical record review focused on 2 main questions: 1) "Was photocoagulation suboptimally timed?" and if yes, 2) "What were the clinical circumstances surrounding suboptimal care?" Photocoagulation was considered suboptimally timed if vision was impaired or threatened by retinal disease and that earlier photocoagulation could have substantially decreased or delayed this complication. This included 1) significant preretinal or vitreous hemorrhage or macular traction retinal detachment, 2) clinically significant macular edema with foveal involvement by fluid or lipid, 3) neovascular glaucoma, or 4) a visual acuity of 20/50 or worse secondary to macular edema or diabetic proliferative retinopathy. Circumstances surrounding suboptimal timing were classified as: 1) "suboptimal screening" (screening at $\geq$ 13-month but $\leq$ 36-month intervals), 2) "no or poor screening" (>36-month intervals or no record of previous screening), 3) "inadequate surveillance" (patients with known retinopathy not seen at

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intervals recommended by eye specialist), 4) "delays in scheduling treatment" (complications related to substantial delays in arranging for angiography or laser treatment), and 5) "rapid progression" (complications despite close follow-up). "Screening" refers to routine examinations in those with no known history of eye disease and "surveillance" refers to follow-up in those with known disease. Simple summary statistics and 95% confidence intervals were calculated.

RESULTS

Demographic information on the study sample is reported in Table 1. We found that patients were often receiving initial photocoagulation much later than is medically indicated. Overall, 43% of cases (95% confidence interval [CI], 36% to 49%) were rated as probably or definitely having suboptimally timed photocoagulation (47% at the university site and 40% at the VA sites; Table 1). However, not a single case of suboptimal timing at any of the three study sites occurred in a patient who went 13 to 36 months between screenings visits (Table 2). In contrast, about one third of cases were due to very poor screening (> 36-month screening intervals or no previous screening), and two thirds of cases were associated with surveillance problems (care of those with known retinopathy), such as 1) failures to achieve close follow-up after early retinopathy was detected, 2) delays in scheduling angiography or photocoagulation surgery after a decision was made to treat, or 3) rapid progression and unanticipated preretinal or vitreous hemorrhage despite close surveillance (Table 2).

DISCUSSION

These results confirm recent epidemiological evidence[9–11] suggesting that if a patient's last retinal examination was normal, the risk of vision-threatening retinopathy occurring within the next 2 to 3 years is extremely low. These findings also suggest that current quality standards and policy initiatives probably fail to focus on the main quality problem. Current policy continues to emphasize annual exams for those with diabetes (although some exceptions are included in some performance measures).[14,15] However, almost the entire quality problem appears to be related to poor screening and inadequate surveillance of known disease. At least at the sites studied, more good could be achieved by decreasing poor screening (>3 years between visits) by 10% than by achieving annual screening in all patients who currently get examinations every 2 to 3 years. Inadequate management of those with known disease was by far the most pressing quality challenge. Our study is limited to only three study sites and relied upon the information available in the medical record, but our results are quite robust and are consistent with other recent epidemiological evidence.[9–11]

This mismatch between the nature of the quality problem and the focus of current performance measures is extremely concerning. Ironically, it is possible that the incentives produced by current performance standards may even be hurting patient care. Considering the strong incentives for health care systems to keep costs down while meeting externally imposed performance standards, mandating superfluous care could potentially divert scarce resources toward unimportant problems, making it more difficult to address truly important quality problems.[7,8,16,17] In an increasingly competitive and complex health care environment, seeking a sense of security by setting overly stringent quality standards (and thus demanding inefficiency) can be both wasteful and harmful.[16,18]

It may seem remarkable that tens of millions of dollars are spent each year measuring and trying to improve annual eye screening[6,8,19] in the absence of any coordinated attempt to understand the circumstances surrounding suboptimally timed photocoagulation. However, quality-monitoring organizations and health care systems only rarely collect systematic information on the causes of potentially preventable complications. The methodological approach used in this study can serve as a model for one practical approach that health care systems or consortia could use to better understand the na-

Table 1. Patient Attributes and the Frequency of Suboptimally Timed Retinal Photocoagulation

	Veterans Affairs Site	University Site
	Frequency (%)	
Age, y*		
<50	8/90 (9)	24/99 (24)
50–64	45/90 (50)	34/99 (34)
≥65	37/90 (41)	41/99 (41)
Male*	114/116 (98)	48/99 (48)
Ethnicity/race		
African-American	111/139 (80)	10/99 (10)
White	27/139 (19)	76/99 (79)
Other	1/139 (1)	11/99 (11)
Probably/definitely suboptimal timing of photocoagulation†	55/139 (40)†	47/99 (47)†

Age and gender data were not recorded at one of the two participating Veterans Administration sites as per Institutional Review Board agreement.

†*Overall, 102 of the 238 cases were rated as probably or definitely suboptimally timed (43%; 95% confidence interval, 36% to 49%).*

Table 2. Circumstances Associated with Suboptimal Timing of Photocoagulation Therapy

Primary Reason for Suboptimally Timed Retinal Photocoagulation	Veterans Administration (*n*=55)*	University Eye Center (*n*=47)*	Overall Results (*N*=102)
	Frequency (%)		
Screening failures†			(95% CI)
Screening performed 13–36 months after last screening	0 (0)	0 (0)	0 (0) (0% to 4%)
No known screening or >36-month interval	18 (33)	15 (32)	33 (32) (23% to 42%)
Surveillance problems†			
Inadequate surveillance intervals	18 (33)	14 (30)	32 (31) (23% to 41%)
Delays in scheduling angiography or treatment	12 (22)	2 (4)	14 (14) (8% to 22%)
Rapid or unanticipated progression	7 (12)	16 (34)	23 (23) (15% to 32%)

**Of those undergoing photocoagulation, 55 of the 139 (40%) VA patients and 47 of the 99 (47%) university patients were rated as probably or definitely having suboptimal timing of photocoagulation.*

†"Screening" refers to routine examinations of asymptomatic patients whose past examinations were normal. "Surveillance" refers to follow-up for known disease.

CI, confidence interval.

ture of quality problems in actual practice.[17,20] Such formative evaluations can help us better direct quality improvement efforts toward the most germane quality problems. For example, efforts to reduce amputations are rarely guided by a careful assessment of the circumstances surrounding potentially preventable amputations. Efforts to improve the timing of emergency revascularization for acute myocardial infarction rarely involve a detailed assessment of the circumstances surrounding delays in treatment. Although the methods used in this study are simple and descriptive, the results of such evaluations can be very useful. If 99% of diabetes-related amputations occur in patients with known neuropathy, it seems unlikely that the amputation rate could be reduced by increasing monofilament screening. If it commonly takes more than an hour for patients with acute myocardial infarctions to get seen by a clinician in the emergency department, finding a way to decrease that initial delay would be an essential component of improving timely revascularization or thrombolytic therapy.

In summary, we found that suboptimal timing of photocoagulation was common, but was almost exclusively due to 1) inadequate close follow-up and timely treatment of patients with known retinopathy (surveillance), and 2) very long screening intervals (>3 years). These results are consistent with previously published epidemiological evidence[9–12] and suggest that current policies fail to target the true quality problem. Whether guidelines regarding annual screening should be changed certainly merits consideration. However, implementing every other year screening without also implementing a proactive system for targeting and tracking patients could substantially hurt quality, and such systems may best be located in eye specialty clinics rather than assigning the principal responsibility for coordinating eye care to busy primary care physicians.[9,17,18] Still, whether guidelines recommend annual or biannual screening, the recommendations should allow for reasonable individual discretion.[16] Given the extensive evidence that has emerged over the past 4 years,[9–12,21] we conclude that performance measures for screening should be changed to allow clinicians, patients, and health care systems the discretion of opting for every other year screening. When performance standards insist upon discretionary care, we risk systematizing inefficiency and mandating care that runs counter to what many patients would want if they were appropriately informed of the known risks and benefits.[16–18] Finally, and most importantly, health care systems should be encouraged to target more resources and attention to aggressive follow-up of those with known retinopathy and preventing long screening intervals, as doing so appears to have the greatest chance of helping preserve vision in people with diabetes.

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