Eye Disease in Veterans With Diabetes

JAMES ORCUTT, MD[1,2]
ARPENIK AVAKIAN, MD[2]
THOMAS D. KOEPSELL, MD, MPH[3,4,5]
CHARLES MAYNARD, PHD[3,5]

OBJECTIVE — To describe the screening, prevalence, and management of eye disease in veterans cared for by the Veterans Affairs (VA) System.

RESEARCH DESIGN AND METHODS — Eye examinations, treatments, and diseases were identified in veterans with diabetes who received care in inpatient and outpatient VA settings during FY1998. Analysis was conducted to characterize the patient population and screened population and to compare them to the total VA patient population with diabetes. Logistic regression was performed to predict eye screening.

RESULTS — Overall 48% of veterans with diabetes had an eye examination in FY1998. One-third of all veterans had an eye condition and 8.6% of veterans had ophthalmic manifestations of diabetes. In addition 11% reported glaucoma and 17.8% reported cataract surgery. Approximately 11,500 (2.7%) veterans were blind.

CONCLUSIONS — Visual impairment is a common complication of diabetes. Half of this population of veterans had a visual examination recorded in VA. The VA is testing a more targeted screening and treatment approach for diabetic eye disease in order to prevent the serious eye complications.

Diabetes Care **27 (Suppl. 2):B50–B53, 2004**

Diabetes is the principal cause of visual impairment and blindness in the U.S. (1). In people with diabetes, vision loss may result from complications such as diabetic retinopathy, cataracts, and glaucoma (2). In the Wisconsin Epidemiologic Study of Diabetic Retinopathy, 15 years after the diagnosis of diabetes, retinopathy was evident in nearly 97% with type 1 diabetes, 80% with type 2 diabetes treated with insulin, and 55% of type 2 diabetes patients not treated with insulin. The most severe stage of retinopathy, proliferative retinopathy, was evident 15 years after diagnosis in 30% with type 1 diabetes, 10–15% with type 2 diabetes treated with insulin, and 5% with type 2 diabetes not treated with insulin (1). Based on the data reported from the National Society to Prevent Blindness, which were provided by from the Model Reporting Area (MRA) registry, the indicated prevalence of legal blindness attributed to diabetes in the U.S. was estimated to be 6.1% among males and 9.7% among females (3). According to the American Diabetes Association, diabetes is responsible for 8% of legal blindness, making it the leading cause of new cases of blindness in adults 20–74 years of age in the U.S. Each year, 12,000–24,000 cases of blindness are attributable to diabetes (4).

The diagnosis and timely treatment of diabetes-related eye diseases are major challenges for health care providers and their patients. Documented risk factors for blindness or visual impairment include severe retinopathy, older age at diabetes onset, long duration, and Hispanic or African-American ethnicity (2,5). Recent reports have emphasized the cost-effectiveness of adequate screening and have demonstrated a 33% reduction in blindness following improvement in diabetes retinopathy screening (6).

The combination of regular eye examinations, appropriate referral, and timely treatment leads to the best visual outcomes. The opportunity to examine eye disease in veterans prompted this study, which is designed to *1*) describe the prevalence of eye disease in persons with diabetes in the Veterans Administration (VA) and *2*) assess the state of screening and management of diabetes-related eye conditions in the VA.

RESEARCH DESIGN AND METHODS

— The study included 429,918 individuals with diabetes who were treated in the VA system during FY1998. These veterans were identified from the Patient Treatment File (PTF), which captures inpatient discharge data, and the Outpatient Care (OPC) file. Individuals were included if they were hospitalized at least once during FY1998 and had ICD-9 code 250.xx in at least 1 of 11 diagnostic variables contained in the PTF. Patients who had at least three outpatient visits, with one of them having a 250.xx ICD-9 code in the OPC file, were also selected.

Eye diseases were grouped into 10 categories, defined by ICD-9 diagnosis codes, as shown in the Appendix. In addition, based on information in the OPC (Stop Codes 407 [Ophthalmology] or 408 [Optometry]), we determined whether an individual had an eye examination performed in FY1998. Specific treatments received were classified by ICD-9 procedure and CPT codes, depending on whether the procedure was performed in the hospital or clinic. Procedures of interest and their corresponding codes are also shown in the Appendix.

Patient age, sex, race, and region of the country were also collected from the

From the [1]Department of Ophthalmology, VA Puget Sound Health Care System, Seattle, Washington; the [2]Department of Opthamology, University of Washington, Seattle, Washington; [3]Seattle ERIC, VA Puget Sound Health Care System, Seattle, Washington; the [4]Department of Epidemiology, University of Washington, Seattle, Washington; and the [5]Department of Health Services, University of Washington, Seattle, Washington.

Address correspondence and reprint requests to James Orcutt, MD, Department of Ophthalmology, VA Puget Sound Health Care System, 1660 S. Columbian Way, Seattle, WA 98108. E-mail: jorcutt@u.washington.edu.

Received for publication 1 July 2003 and accepted 25 July 2003.

Funding for this supplement was provided by The Seattle Epidemiologic Research and Information Center and the VA Cooperative Studies Program.

Abbreviations: VA, Department of Veterans Affairs.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

Table 1—*Frequency of diabetes eye screening during FY1998 in relation to selected patient characteristics*

Variable	Total	% of sample	No. screened	% screened
Total	429,918	100	206,179	48
Age (years)				
<55	99,178	23	44,739	45
55–64	93,621	22	47,123	50
65–74	154,467	36	76,516	50
≥75	82,652	19	37,801	46
Sex				
Male	418,924	97	217,547	48
Female	10,994	3	6,192	44
Ethnic/racial status				
White	241,548	56	121,937	50
African American	65,985	15	33,391	51
Hispanic white	24,896	6	10,666	43
Hispanic black	1,648	<1	775	47
Native American	1,747	<1	831	48
Asian/Pacific Islander	2,046	<1	1,089	53
Unknown	92,048	21	36,950	40
Region				
Northeast	91,819	21	48,340	53
South	163,044	38	69,598	43
Midwest	92,134	21	46,697	51
West	82,921	19	41,544	50
Amputation in last 10 years	11,794	3	5,750	49
Amputation in FY1998	2,267	1	1,346	59

same two data sources. To identify a subset of patients with relatively advanced diabetic vascular disease, we also identified patients who had had lower-limb amputations performed in FY1998 or earlier. These procedures ranged from toe to above-knee amputations.

In keeping with the descriptive nature of the study, percentages and odds ratios are reported without *P* values. Because of the very large sample sizes, even clinically unimportant differences can achieve statistical significance.

RESULTS — Overall, 48% of patients with diabetes received an eye examination in FY1998 (Table 1). Eye-screening rates were slightly higher in the 55–64 and 65–74 age-groups than in younger or older veterans. Screening rates were lower in women than in men (44 vs. 48%), although women comprised only 3% of veterans with diabetes. With respect to race/ethnicity, the percent of persons with diabetes screened ranged from 40% for the "Unknown" group to 53% in the Asian/Pacific Islander group. White and African-American patients comprised almost 72% of veterans with diabetes; >50% of patients in these two groups were screened. The screening rate for Hispanic white individuals was considerably lower than rates for other racial groups. Eye-screening rates in the Northeast, Midwest, and West were similar, although rates in the South, the most populous region, were considerably lower. Finally, 49% of veterans who had had a lower-limb amputation during the last decade were screened for eye disease in FY1998; this rate increased to 59% for those veterans who had amputations in FY1998.

Table 2 shows that the pattern of variation in screening rates was largely unchanged in multivariate analysis. Differences by sex were slightly weaker after adjustment for the other predictors shown, but associations with receiving care in the Southern region or with having an amputation in FY1998 were slightly stronger.

As seen in Table 3, more than one-third of veterans with diabetes were recorded as having at least one qualifying eye condition, and 8.6% were listed as having eye disease specifically related to diabetes. The most commonly recorded eye conditions overall were cataract (17.8%), retinopathy/retinal vitreous disorders (9.5%), and glaucoma (11.0%). Notably, 11,567 veterans with diabetes were blind. These diagnostic categories are not mutually exclusive; thus, a patient could have more than one condition.

We subsequently analyzed glaucoma in veterans with and without diabetes. In FY2000, there were 1.98 million veterans who did not have diabetes and had at least three clinic visits during the year. Of these, ~109,000, or 5.5%, had a glaucoma diagnosis. During that same year, 11% of the veterans with diabetes had a glaucoma diagnosis—the same percent as in FY1998.

The distribution of various eye procedures performed in persons with diabetes is shown in Table 4. Laser surgery and cataract extraction were most common, performed in 1.2 and 1.6% of persons with diabetes in FY1998, respectively.

CONCLUSIONS — An important finding of this study was that 48% of veterans defined as having diabetes received an eye exam in FY1998. VA guidelines call for an annual eye examination or a biennial follow-up examination in patients who have diabetes, a normal baseline eye examination, HbA_{1c} <8%, and no risk factors for retinopathy. The proportion of veterans to whom this guideline would apply cannot be determined from the data. Other studies have used different criteria for identifying persons with diabetes. For instance, VA Quality Management reviews diabetes care by contract to an external peer review program. The operational definition of diabetes used in the external peer review program review requires at least three visits in one of eight primary care clinics during the fiscal year, with at least one of these visits associated with an ICD-9 code of 250.xx. Review of computerized medical records is used to document that an ophthalmologist or optometrist within the VA performed an eye examination, or that the patient received eye care outside the VA within the previous 12 months. Using external peer review program criteria, 62% of veterans received an annual eye examination, in contrast to the 48% screening rate noted here.

Allocation of scarce eye care resources between the times of screening and treat-

Table 2—*Predictors of diabetes eye screening: results of logistic regression*

	Univariate		Multivariate	
Variable	OR	95% CI	OR	95% CI
Age (years)				
<55	0.76	0.74–0.79	0.80	0.78–0.83
55–64	1.12	1.10–1.14	1.16	1.14–1.18
65–74	1.16	1.14–1.18	1.17	1.15–1.19
≥75	1.00	Reference	1.00	Reference
Sex				
Male	1.19	1.15–1.24	1.12	1.08–1.16
Ethnic/racial status				
White	1.52	1.50–1.54	1.52	1.50–1.55
African American	1.58	1.55–1.61	1.65	1.62–1.69
Hispanic white	1.12	1.09–1.15	1.22	1.19–1.26
Hispanic black	1.32	1.20–1.46	1.39	1.26–1.53
Native American	1.35	1.23–1.49	1.33	1.21–1.46
Asian/Pacific Islander	1.70	1.55–1.85	1.58	1.44–1.72
Unknown	1.00	Reference	1.00	Reference
Region				
Northeast	1.11	1.09–1.13	1.07	1.05–1.09
South	0.74	0.73–0.75	0.72	0.70–0.73
Midwest	1.02	1.00–1.04	0.99	0.97–1.01
West	1.00	Reference	1.00	Reference
Amputation in last 10 years	1.14	1.10–1.19	1.16	1.12–1.21
Amputation in FY1998	0.74	0.68–0.81	0.59	0.54–0.65

CI, confidence interval; OR, odds ratio, adjusted for all other variables shown.

ment may also be an issue. Data from the U.K. Prospective Diabetes Study reported only 0.1% of the 2,316 patients with no retinopathy on their last visual exam needed laser therapy within 3 years, as compared with 15.3% of the 509 patients with an abnormality on their last retinal exam (7). Similarly, the Diabetes QUERI Research Coordinating Center reported 25–40% of patients with diabetes who were undergoing laser therapy had visual loss that probably could have been prevented by earlier treatment. This problem usually resulted from inadequate follow-up of those with known moderate disease rather than identification of unknown moderate or severe retinopathy from a visual screening exam. These data suggest more emphasis was needed for the 15–20% of people with diabetes with moderate eye disease. A VA research project is now under way to determine the impact of using a "progressive Reminder and Scheduling System," wherein the intensity of follow-up and reminders is based on the patient's risk of proliferative retinopathy or macular edema (8).

Screening rates for diabetic retinopathy and other eye conditions in settings other than the VA vary considerably. Findings from a national probability sample of persons with diabetes indicated that 50% received eye exams in 1 year (9). Others have argued that the true figure may be closer to 25%, particularly for individuals in disadvantaged communities (10,11). In the current study, annual screening rates were lower for Hispanic veterans and those residing in the South. Further investigation beyond the scope of this report is needed to account for these differences.

The finding that 59% of persons with diabetes who had a lower-limb amputation in FY1998 also had an eye exam in the same year is important. Having a lower-extremity amputation for diabetes-related reasons increases risk for diabetic retinopathy (12). Because these patients have a high risk of blindness, VA diabetes guidelines require that they be examined within 1 month of amputation and at least yearly thereafter.

The distribution of the various eye conditions among screened persons with diabetes was informative. Both glaucoma and cataracts, conditions requiring medical and/or surgical treatment, were common among persons with diabetes receiving eye exams, which may suggest that screening for diabetic retinopathy alone may not be sufficient. Future VA policies should explore the possibility of including screening for cataract and glaucoma.

Eye procedures performed in persons with diabetes comprised about one-fourth of all eye surgeries performed in the VA system in FY1998. The major treatment modalities were laser surgery and cataract extraction. This result is consistent with the finding that retinal disorders and cataracts were the most frequently encountered eye conditions among screened persons with diabetes. This further supports the conclu-

Table 3—*Eye conditions in veterans with diabetes seen in VA inpatient and outpatient settings, FY1998*

Condition	No. with condition (N = 429,918)	% with condition
Any eye condition	147,997	34.4
Ophthalmic manifestations of diabetes	37,080	8.6
Retinal		
Background proliferative retinopathy	40,853	9.5
Retinal edema	5,395	1.3
Proliferative retinopathy	8,181	1.9
Vitreous hemorrhage	1,409	0.3
Retinal detachment	3,665	0.9
Anterior segment disease		
Glaucoma	47,239	11.0
Chronic open angle	20,745	4.8
Rubeosis	342	0.1
Cataract	76,655	17.8
Cranial nerve palsy	12	<0.1
Blindness	11,567	2.7

Table 4—*Eye procedures performed for veterans with diabetes in VA inpatient and outpatient settings, FY1998*

Procedure	*n*	%
Laser surgery	5,154	1.2
Operative surgery		
Vitrectomy	861	0.2
Repair of detachment	311	0.1
Glaucoma trabeculectomy	795	0.2
Cyclodestructive procedure	52	0.0
Cataract extraction	6,842	1.6
Enucleation	37	0.0

sion that cataract extraction is an important management issue for diabetes care. Glaucoma, the other frequently encountered eye disease, is often medically treated and is not captured in this report.

Nearly 5% of all persons with diabetes examined by an ophthalmologist in FY1998 were blind. These 11,567 veterans require rehabilitation and care in a VA health care system. Blindness is significant not only in human suffering, but also in great financial cost to the VA. The annual cost to care for a blind veteran who has training in the Blind Rehabilitation Center in the first year is ~$20,000–25,000. Reducing the incidence of blindness will not only improve the quality of life of persons with diabetes, but may also save the VA significant resources. Blindness due to diabetes is thought to be preventable in many instances. Our data suggest that the VA needs to consider providing more screening and treatment for diabetic eye disease.

A limitation of this report is that the selection of persons with diabetes was based on hospitalization or clinic visits. Variations in outcomes of eye care in patients with diabetes can be accounted for by the definition one uses for a diabetic patient and how the provision of an annual eye examination is noted. Making these definitions strict and consistent would allow more accurate comparison across institutions and patient subgroups. However, a restrictive definition may eliminate some persons with diabetes who in fact are receiving eye care. The definition employed in this study is fairly "loose," in that it included patients who were hospitalized or were seen in the clinic at least three times during the year, with a diagnostic code for diabetes recorded at least once. Laboratory or pharmacy data were not available to further refine the selection of these patients.

The results of our research should be helpful for understanding the provision of eye care to veterans with diabetes in the VA system and may be important in defining future strategies for the diagnosis and management of eye disorders in this important group of veterans.

Appendix—*Classification of eye diseases and procedures*

Disease category	ICD code(s)
1. Ophthalmic manifestations of diabetes	250.5x
2. Background proliferative retinopathy	362.01
3. Retinal edema	362.83
4. Proliferative retinopathy	362.02
5. Vitreous hemorrhage	379.23
6. Retinal detachment	361.xx
7. Glaucoma	365.xx
8. Cataract	366.xx
9. Cranial nerve palsy	951.0, 951.1, 951.3
10. Blindness	369.xx

Procedure	ICD code(s)	CPT code(s)
1. Laser surgery	14.21–14.25	67210, 67227–8, 67145
2. Vitrectomy	14.7x	67030–1, 67036, 67038–40
3. Retinal detachment repair	14.4x, 14.5x	67110, 67105, 67107–8, 67110, 67112
4. Glaucoma trabeculectomy	12.6x	65855, 66150–66180
5. Cataract extraction	13.2x–13.5x	66850–66984
6. Enucleation	16.4	65101, 65103, 65105, 65093

References

1. Klein R, Klein BEK: Vision disorders in diabetes. In *Diabetes in America*. 2nd ed. Harris MI, Cowie CC, Stern MP, Boyko EJ, Reiber GE, Bennett PH, Eds. Bethesda, MD, National Institutes of Health, National Institutes of Diabetes and Digestive and Kidney Disease, U. S. Govt. Printing Office (NIH publ. no. 95-1468), 1995, p. 293–338
2. Javitt JC, Aiello LP, Chiang Y, Ferris FL, Canner JK, Greenfields S: Preventive eye care in people with diabetes in cost-saving to the federal government: implications for health-care reform. *Diabetes Care* 17: 909–917, 1994
3. National Society to Prevent Blindness: *Vision Problems in the US. Data Analysis, Definitions, Data Sources, Detailed Data Tables, Analyses, Interpretation*. New York, National Society to Prevent Blindness, 1980
4. American Diabetes Association: Facts and Figures: Diabetes and Eye Disease [article online], 2003. Available from http://www.diabetes.org/main/info/facts/eye/default.jsp. Accessed 28 June 2003
5. Backlund LB, Algvere PV, Rosenqvist U: New blindness in diabetes reduced by more than one-third in Stockholm county. *Diabet Med* 14:732–740, 1997
6. Vijan S, Hofer TP, Hayward RA: Cost-utility analysis of screening intervals for diabetic retinopathy in patients with type 2 diabetes mellitus. *JAMA* 283:889–896, 2000
7. Kohner EM, Stratton IM, Aldington SJ, Holman RR, Matthews DR: Relationship between the severity of retinopathy and progression to photocoagulation in patients with type 2 diabetes mellitus in the UKPDS (UKPDS 52). *Diabet Med* 18:178–184, 2001
8. Hayward R, Pogach L: *VA QUERI Diabetes Mellitus Report*. Washington, D.C., U. S. Govt. Printing Office, 2002
9. Brechner RJ, Herman WH, Will JC, Cowie K, Harris MI: Survey of physicians' practices related to the treatment of people with diabetes mellitus. *JAMA* 270:1714–1718, 1993
10. Wylie-Rosett J, Basch C, Walker EA, Zybert P, Shamoon H, Engel S, Cypress M: Ophthalmic referral rates for patients with diabetes in primary-care clinics located in disadvantaged communities. *J Diabetes Complications* 9:49–54, 1995
11. Pasagian-Macauly A, Basch CE, Zybert P, Wylie-Rosett: Ophthalmic knowledge and belief among women with diabetes. *Diabetes Educator* 23:433–437, 1997
12. Moss SE, Klein R, Klein BE: The 14-year incidence of lower-extremity amputations in a diabetic population: the Wisconsin Epidemiologic Study of Diabetic Retinopathy. *Diabetes Care* 22:951–959, 1999