Probability of Filtration Surgery in Patients With Open-angle Glaucoma

Matthew G. Hattenhauer, MD; Douglas H. Johnson, MD; Helen H. Ing, RN; David O. Hodge, MS; Linda C. Butterfield, MD; David C. Herman, MD; Darryl T. Gray, MD, ScD

Objective: To investigate the probability of undergoing filtration surgery in either 1 or both eyes in patients in whom open-angle glaucoma was newly diagnosed.

Methods and Design: A retrospective community-based study of 295 residents of Olmsted County, Minnesota, in whom open-angle glaucoma was newly diagnosed between January 1, 1965, and December 31, 1980, was performed. Kaplan-Meier methods were used to estimate the cumulative probability of undergoing filtration surgery during a 20-year period.

Results: At 20 years of follow-up, the Kaplan-Meier cumulative probability of undergoing filtration surgery in at least 1 eye was estimated to be 23% (95% confidence interval, 16%-30%), and in both eyes the estimate was 12% (95% confidence interval, 6%-17%). Patients with optic nerve damage at the time of diagnosis were more likely to undergo surgery than patients with elevated intraocular pressure but no damage (1 eye, 39% vs 15%; both eyes, 27% vs 5%).

Conclusion: This retrospective study of a white population newly diagnosed as having and treated for open-angle glaucoma indicates that while most patients did not undergo filtration surgery in the course of glaucoma therapy, at least one third of those with glaucomatous damage at the time of diagnosis underwent filtration surgery.


As a worldwide cause of blindness, glaucoma ranks among the top permanent visually debilitating diseases.1 While there is no cure for open-angle glaucoma (OAG), there are various treatment options that lower intraocular pressure (IOP) and may, therefore, slow the progressive loss of visual field associated with the disease. Topical and systemic medications, laser trabeculoplasty, and filtration surgery are common methods used in an attempt to lower IOP. The role and timing of these therapeutic options often vary based on the clinician’s training and experience, as well as the severity of the disease. Traditionally, ophthalmologists in the United States have followed a stepwise approach in the management of OAG, with extensive use of topical ocular hypotensive medications, followed by laser trabeculoplasty, and then filtration surgery. European clinicians have been more aggressive in their treatment of OAG, with filtration surgery recommended either as initial therapy or after a trial of a topical medication fails to control IOP or the progression of visual field loss.2,3 The reevaluation of treatment strategy in the United States has led to several large multicentered studies, including the Collaborative Initial Glaucoma Treatment Study4 and the Glaucoma Laser Trial,5 that compare surgical intervention with medical therapy in the treatment of OAG.

For editorial comment see page 1236

Consideration of a more aggressive approach to reduction of IOP with early surgery has evolved, in part, because of the fact that blindness from OAG can occur even while patients are receiving therapy.6 In a previous study,6 we reported the Kaplan-Meier 20-year cumulative probability of blindness in patients in whom OAG was newly diagnosed January 1, 1965, through December 31, 1980. This probability of blindness was estimated to be 27% (95% confidence interval, 20%-33%) in at least 1 eye and 9% (95% confidence interval, 5%-14%) in both eyes.6 At the time of initial diagnosis, those eyes with evidence of optic disc and/or visual field loss from glaucoma had a greater probability of blindness than did those eyes...
SUBJECTS AND METHODS

The present study is a retrospective, community-based, longitudinal study of residents of Olmsted County, Minnesota, in whom OAG was newly diagnosed from January 1, 1965, through December 31, 1980. This period was chosen to allow for adequate follow-up after diagnosis.

Study patients were identified through a computerized search of the database of the Rochester Epidemiology Project, a medical records linkage system established to study the occurrence and natural history of disease among the residents of Rochester, Minn, and the balance of Olmsted County. Using this system, population-based studies can be conducted because almost all medical care is provided to area residents by Rochester institutions affiliated with the Mayo Clinic or Olmsted Medical Center. A medical record system is used by the Mayo Clinic and its affiliated hospitals whereby all data on inpatient and outpatient care is assembled in 1 place. These medical histories can be retrieved for study because, for almost a century, the Mayo Clinic and its affiliated hospitals have maintained extensive indexes based on clinical and histological diagnoses made and procedures performed. The Rochester Epidemiology Project also maintains indexes for Olmsted Medical Center and its affiliated hospital, the Olmsted Community Hospital. Information on diagnoses and procedures performed for Olmsted County residents treated as inpatients at other regional facilities, such as the Minneapolis Department of Veteran’s Affairs Hospital and the University of Minnesota, both 144 km (90 miles) away in Minneapolis, is also available. The result is the linkage of medical records from essentially all sources of medical care used by the local population in Olmsted County. The completeness of the Rochester Epidemiology Project’s capture of data on ophthalmologic care provided to Olmsted County residents has been documented elsewhere.

All medical records of patients with a new diagnosis of OAG, suspected glaucoma, or ocular hypertension made by ophthalmologists between 1965 and 1980 at 1 of the 2 institutions in Olmsted County were reviewed. A pre-coded data form was used to record demographic and clinical information that included the following: patient’s age and sex, visual acuity and IOP, optic disc description and visual field test results at diagnosis, date of initiation of glaucoma therapy, type and subgroup of OAG, and intraocular surgical procedures performed after the diagnosis of OAG. If the patient developed blindness, the date of the diagnosis of blindness, the affected eye, and the cause of the blindness were recorded.

RESULTS

Two hundred ninety-five patients in whom OAG was newly diagnosed were identified during the 20-year period. Primary OAG was diagnosed in 89.8% (265/295), exfoliative glaucoma in 8.5% (25/295), and pigmentary glaucoma in 1.7% (5/295). Based on the classification previously described, 177 patients (60%) were classified as having treated ocular hypertension, 114 (38.6%) were identified as having classic glaucoma, and 4 (1.4%) were classified as having unsupported glaucoma.

Sixty-three percent of patients were women; and most patients (95.9%) were white. The median age at diagnosis of OAG was 68 years; and the mean ± SD follow-up time was 15 ± 8 years (range, 9 days to 32 years) (Table 1).

Of the 295 patients, 29 (9.8%) were blind in at least 1 eye at the time of glaucoma diagnosis. All 29 of these
patients were included in the analysis of the probability of undergoing a filtration procedure. In these 29 patients, there were 3 eyes that had a filtration procedure after the diagnosis of blindness was made. A total of 48 filtration procedures were performed, of which 41 were guarded trabeculectomies. Seven full-thickness procedures were noted. No cyclodialysis operations were performed during this period.

In Table 2, the Kaplan-Meier cumulative probability of undergoing filtration surgery in at least 1 eye is shown. A 23% probability was calculated when patients with treated ocular hypertension and classic glaucoma were considered together (Figure 1). Separately, the treated ocular hypertension group and the classic glaucoma group were calculated to have a 15% and 39% probability at 20 years, respectively (Figure 2). Because of the nature of Kaplan-Meier analysis, the sum of the probabilities for treated ocular hypertension and classic glaucoma exceeds 23%.

Table 3 shows the Kaplan-Meier cumulative probability of a patient newly diagnosed as having and treated for OAG undergoing a filtration procedure in both eyes. Considering treated ocular hypertension and classic glaucoma together, the probability was 12% at 20 years (Figure 3). When considered separately, the treated ocular hypertension and classic glaucoma groups were calculated to have a 5% and 27% probability at 20 years, respectively (Figure 4).

The results of this retrospective longitudinal study of a community-based population suggest that the probabili-
tions for the reduction of IOP during the past 30 years have increased dramatically. It is possible that this data may overestimate the probability of filtration surgery in current ophthalmic practice because there are many new therapeutic options available, including an expanded arsenal of topical medications.

In this study, a combined cataract and trabeculectomy procedure was not included as a filtering procedure. The rationale for this revolves around the fact that a combined procedure is not always performed because the IOP is poorly controlled. At times, a cataract extraction in a patient with glaucoma is combined with a trabeculectomy in an effort to reduce the number of glaucoma medications. Because this study was retrospective in nature, the ability to determine the exact reason for a combined procedure was limited. Therefore, combined cases were not included in the analysis for the probability of filtration surgery. Eleven combined procedures were identified among the cohort of patients in this study.

The traditional stepped approach to therapy for glaucoma management was common among the patients in this study. Although trabeculectomy was not commonly the first line of therapy for OAG in this population, those patients with classic glaucoma had a 39% probability of having filtration surgery in at least 1 eye and a 27% probability in both eyes at 20 years of follow-up. In a previous study, the probability of blindness was calculated by Kaplan-Meier methods for this same cohort of patients. In the treated ocular hypertension group, this was estimated to be 4% in both eyes and 14% in at least 1 eye at 20 years. In the classic glaucoma group, the estimate for blindness at 20 years in both eyes was 22% and in at least 1 eye it was 54%. Data from that study, as well as from the present study, demonstrate that patients who have glaucomatous damage at the time of diagnosis are more likely to require filtration surgery during the course of glaucoma management. Those patients are also more likely to develop blindness from OAG than are those patients who have an elevated IOP but no evidence of glaucomatous optic disc or visual field changes. Presumably, patients with glaucomatous damage required a lower IOP and, therefore, surgical intervention occurred more frequently in an effort to achieve a lower pressure. Further analysis of the glaucoma management in those patients who developed blindness compared with those patients who did not develop blindness in this study population may provide further information regarding the development of blindness in OAG.

There are several limitations of this study, including the fact that the small number of patients resulted in fairly wide confidence intervals for the calculated probabilities in some cases. The retrospective nature of the study precluded the consistent availability of standardized documentation of ophthalmic data at the time of examination. The racially homogeneous nature of the population in Olmsted County (98% white in 1980 compared with 83% white for the United States) means that this information may not be applicable to other populations. On the other hand, the stability of this non-referral population and the uniqueness of the Rochester Epidemiology Project made it possible to assemble long-term follow-up data on a population that is not expected to have overrepresentation of severe disease. Fur-
thermore, in the population studied in this retrospective report, OAG was diagnosed between 1965 and 1980, and data were abstracted until the last follow-up in Olmsted County, with more than 30 years of follow-up available in some cases. In conclusion, the results of this retrospective community-based study of a predominantly white population suggest that most patients newly diagnosed as having and treated for OAG did not undergo filtration surgery as estimated by Kaplan-Meier methods during a 20-year period. However, those patients who had glaucomatous damage at the time of diagnosis were more likely to undergo filtration surgery compared with those who did not have glaucomatous optic disc or visual field damage. This suggests that early diagnosis of OAG is important in the context of filtration surgery.

Accepted for publication March 2, 1999.

This study was supported in part by Research to Prevent Blindness Inc, New York, NY; the Mayo Foundation, Rochester, Minn; and grant AR 30582 from the National Institutes of Health, Bethesda, Md.

Reprints: Douglas H. Johnson, MD, Mayo Clinic, 200 First St SW, Rochester, MN 55905.

REFERENCES

From the Archives of the ARCHIVES

A look at the past . . .

H OLMGREN has suffered from a relative central scotoma in his right eye, coming on from dazzling with light in 1880. In the region of the scotoma he has macropsia, metamorphopsia, and a certain degree of red blindness. By fixing a rectangular object with each eye he was able to determine the degree of the macropsia. With small objects the increase in apparent size was considerable, with larger objects it was less, and with objects of a certain size there was no apparent enlargement. This size corresponded in extent to the scotoma formed.