# Screening for Primary Open-Angle Glaucoma in the Primary Care Setting: An Update for the U.S. Preventive Services Task Force

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Glaucoma is an optic nerve neuropathy that leads to progressive visual field loss. Primary open-angle glaucoma (POAG), the most common type, affects an estimated 2.5 million persons in the United States, 130,000 of whom will be blind as a result.[1] In most patients with POAG, however, loss of vision occurs so slowly that the average patient with POAG diagnosed at age 60 years will probably not become legally blind in either eye within his or her lifetime.[2]

A definitive POAG diagnosis is based on characteristic degenerative changes in the optic disc and progressive loss of visual field sensitivity. Although most persons with POAG have intraocular pressures of greater than 21 mm Hg (the upper limit of normal), 25% to 50% have normal intraocular pressure measurements, a condition known as normal-tension glaucoma.[3] Other risk factors include advanced age and family history of glaucoma.[4] African descent is also an important risk factor. POAG prevalence in blacks is 4 times greater than in whites[5] and is the leading cause of blindness in African Americans.

In 1996, the United States Preventive Services Task Force (USPSTF) found insufficient evidence to recommend for or against routine glaucoma screening in primary care practice.[6] The USPSTF noted that although glaucoma treatment with medications or surgery to lower intraocular pressure had been the standard of care for many years, definitive evidence supporting the benefit of treating persons with early glaucoma and minimal visual impairment was not available. To support an updated USPSTF recommendation, we critically reviewed the literature for new evidence on the effectiveness of screening and treatment for early POAG. This article briefly summarizes the findings of the evidence synthesis, which is available online at http://www.preventiveservices.ahrq.gov/.

# Methods

We searched MEDLINE®, the Cochrane Database of Systematic Reviews, and the Cochrane Controlled Trials Register from 1994 to May 2004 to identify randomized clinical trials of screening for and treatment of primary POAG. We identified additional studies from citations in relevant articles and experts in glaucoma screening and treatment. Two reviewers abstracted relevant information and graded articles according to USPSTF criteria.[7]

# Results

## Screening for POAG

We found no randomized, controlled trials examining the effectiveness of screening and treating asymptomatic individuals for POAG in reducing or delaying progression of vision-related functional impairment. We also found no prospective studies examining the accuracy and reliability of screening for early POAG among asymptomatic patients in the primary care setting.

Although increased intraocular pressure is a risk factor for glaucoma, the effectiveness of intraocular pressure measurement as a population-screening tool for POAG appears to be limited. Many persons with POAG have normal intraocular pressure. Intraocular pressure measurements above the usual cutoff point (greater than 21 mg Hg) have an estimated sensitivity of 47% and specificity of 92% for diagnosing POAG, and intraocular pressure measurement does not appear to perform better in high-risk groups defined by age, race, sex, or family history.[8]

Degenerative changes in the optic disc are characteristic of POAG. A dilated eye examination with direct ophthalmoscopy by an ophthalmologist has a reported sensitivity of 59% and a specificity of 73% for detecting and classifying optic disc changes associated with glaucoma.[9] No data are available on the accuracy and reliability of direct ophthalmoscopy by primary care physicians for detecting degenerative optic disc changes associated with early POAG.

POAG also leads to characteristic patterns of visual field loss that are important to a definitive diagnosis.[2] Perimetry assesses visual field deficits by mapping a patient's response to visual stimuli in various locations within the visual field. The reported sensitivity and specificity of perimetry varies based on the method used and the cutoff point for defining visual field defects, as well the test used as the reference standard.[10] The American Academy of Ophthalmology does not recommend visual field screening by perimetry as part of an eye specialist's medical examination.[11]

## Prevention and Treatment of Early POAG

We found one good-quality randomized trial in patients with ocular hypertension (intraocular pressure greater than 21 mm Hg) examining the efficacy of treatment to delay onset of POAG with topical medications to lower intraocular pressure compared with no treatment. At 5 years, 4.4% of treated patients and 9.5% of untreated patients developed POAG (hazard ratio, 0.40; 95% CI, 0.27-0.59; number need to treat (NNT) 19.6).[12] Because most patients with ocular hypertension do not develop POAG, however, whether ocular hypertension should be treated before the onset of POAG is controversial.[13,14]

Several recent randomized trials have examined the efficacy of different treatment regimens for POAG.[15-18] Only 2 trials compared treated patients with an untreated control group.[19,20]

The Early Manifest Glaucoma Trial (EMGT)[19] was a good-quality Swedish trial comparing the efficacy of treatment with argon laser trabeculoplasty and topical medications vs no treatment for 255 white participants with newly diagnosed, early POAG. After a median follow-up period of 6 years, a trial endpoint of POAG progression based on new visual field loss, optic disc deterioration, or both, was observed in 45% of treated patients vs 62% of the control group (absolute risk reduction [ARR] 17%; NNT 5.9; $P = .007$) The median time to progression was 66 months in treated patients compared with 48 months in the control group.

The EMGT study included patients with early POAG who had either normal or elevated intraocular pressure. A second controlled trial, the Collaborative Normal-Tension Glaucoma Study (CNTGS),[21] included only patients with early POAG and normal intraocular pressure. CNTGS was a fair-quality trial comparing surgery and topical medication with no treatment in one eye each of 145 persons with normal tension glaucoma. At 5 years, an endpoint based on worsening of existing visual field defects or appearance of new visual field defect was observed in 22 of 66 (33%) treated eyes and 31 of 79 (39%) untreated eyes ($P = .21$).

In the CNTGS study, 23 of 66 treated eyes (35%) developed visual acuity loss as a result of cataracts, compared with 11 of 79 eyes in the control group (14%) ($P = .0011$). In a secondary analysis, censoring eyes from further observation at the time cataracts were diagnosed resulted in an apparent reduction in glaucoma progression for treated eyes compared with control eyes ($P = .008$). This analysis, however, did not account for possible glaucoma progression that may occur after cataracts developed. Because most cataracts occurred in treated patients, censoring may have introduced a bias favoring treatment.

## Benefits of Treatment for Early POAG

Two questions arise when interpreting the benefits of treatment for early POAG based on clinical trial outcomes. The first question is what progression means. Presently, there is no standard method for measuring visual field loss in POAG. To reduce potential harms for untreated patients, both EMGT and CNTGS used sensitive measures of visual field loss as progression endpoints. A study comparing progression endpoints used in EMGT and 2 other trials evaluating different treatment regimens found that the 3 endpoints were in agreement when classifying progression for only 23% of patients.[22]

The second question is how progression affects patients' self-reported visual function or health-related quality of life. In a study of glaucoma patients with moderate-to-marked visual field loss, greater visual field loss was associated with significant decreases in self-reported visual function and general health measures.[23] The absolute differences in scores between glaucoma and reference patients with cataracts were small, however, and the clinical importance of these differences was not clear. A second study found moderate correlations between decreased self-reported visual function and both visual field loss and loss of visual acuity.[24] Adjustment for loss of visual acuity, however, reduced the correlation between visual field loss and decreased visual function. Other studies reportedly underway may clarify the relation between visual field loss in early POAG and vision-related function and quality of life.

## Potential Harms of Treatment for Early POAG

The harms of treating early asymptomatic POAG are important when determining the net benefit of treatment. Based on the 6-year results of the EMGT trial, for example, only 1 in 6 patients would be expected to benefit from treatment (ARR 0.21, NNT 5.9). The other 5 patients may be exposed to potential harms of treatment without definite benefit.[19]

The chief harm of treatment is increased risk of cataract formation, particularly with surgery, which may lead to decreased visual acuity. In the EMGT study, treated patients received medication and/or underwent laser treatment. In the treatment group, 6 of 125 (4.8%) of patients had cataract surgery compared with 2 of 122 (1.6%) in the control group (number needed to harm [NNH] 31; $P = .148$). Visual acuity decreased at similar rates with time in both treated patients and the control group. In the CNTGS study, patients in the treatment group received either medication, laser treatment, or surgery to achieve a predetermined reduction of intraocular pressure.[21] In the treatment group, 23 of 61 patients (38%) developed cataracts compared with 11 of 79 (14%) in the control group (NNH 4.8; $P = .0011$). In the treatment group, 16 of 33 (48%) surgically treated patients developed cataracts compared with 7 of 23 (30%) patients treated with medication and laser therapy ($P = .059$). No information was reported on the number of patients who underwent cataract surgery and the impact on visual acuity between treatment and control group patients.

In another trial comparing medical with surgical treatment in patients who had early POAG, surgery was associated with a significantly greater loss in visual acuity during 3.5 years of follow-up.[18] Ocular symptoms, such as dryness, excessive tearing, and itching occur at similar rates in medically and surgically treated patients. Systemic medication side effects (eg, cardiovascular or mental) are uncommon.[4]

## Discussion

No studies examine whether population-based screening of asymptomatic persons for early open-angle glaucoma is effective in improving vision-specific function and quality of life. There is good evidence that treatment to lower intraocular pressure may delay the onset and progression of visual field deficits in some asymptomatic patients with ocular hypertension who do not have POAG (NNT 19.6) and in patients with early primary open-angle glaucoma (NNT 5.9). Treatment does not appear to benefit patients with POAG who have normal intraocular pressure. There are presently no studies that make it possible to interpret the benefit of treatment as a means of preserving vision-specific function. The potential benefits of treatment must be weighed against potential harms, particularly the increased risk for cataract formation.

Population-based glaucoma screening trials using vision-specific function and quality-of-life outcomes would be helpful to determine whether early recognition and treatment of open-angle glaucoma is beneficial. Because blacks are at greater risk for developing POAG, population-based trials will need to include a number of black participants sufficient to detect potential screening benefits.

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This study was conducted by the Oregon Evidence-based Practice Center under contract to the Agency for Healthcare Research and Quality (AHRQ) Contract #290-02-0024, Rockville, MD.

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Reprints of this article and the corresponding recommendation statement are available from the AHRQ Web site (www.preventiveservices.ahrq.gov). The recommendation is also posted on the Web site of the National Guideline Clearinghouse™ (www.guideline.gov).

This first appeared in *Ann Fam Med.* 2005;3:167-170.



**AHRQ Publication No. 04-0548-B**
**March 2005**