Screening for open angle glaucoma

The clinical effectiveness and cost-effectiveness of screening for open angle glaucoma: a systematic review and economic evaluation

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Executive summary

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Executive summary

Background

Glaucoma is the leading cause of irreversible blindness worldwide. Open angle glaucoma (OAG) accounts for about 50% of glaucoma blindness. Prior evaluations of screening effectiveness have concluded that there is insufficient evidence to recommend screening for OAG; recent treatments appear effective in delaying progression, but long-term health outcomes are uncertain. Screening programmes for OAG have not been adopted in any country. In the UK, glaucoma is detected by opportunistic case finding, usually by community optometrists.

Objectives

The objectives of this systematic review were:

- to assess whether OAG screening meets the UK National Screening Committee (NSC) criteria
- to develop a model comparing screening strategies with case finding
- to estimate parameters through systematic reviews
- to model estimates of cost and cost-effectiveness
- to identify areas for future research.

Methods

Screening strategies were developed by wide consultation. In the first ('technician') strategy, the cohort 'at risk' would be invited for examination, based on measurement of intraocular pressure (IOP) and a second 'test' (not prespecified). Screen positives would be referred for specialised optometrist assessment. In the second ('glaucoma optometrist') strategy, the cohort would be invited to a specialised optometrist for assessment. Positives from either strategy would be referred for diagnosis, by an ophthalmologist, as occurs in current case finding ('no screening' strategy).

Markov submodels were developed to represent these strategies. Parameter estimates were determined by systematic reviews of epidemiology, economic evaluations of screening, and effectiveness (test accuracy, screening and treatment). Tailored highly sensitive electronic searches were undertaken. The date of last searches was December 2005.

Results

In the UK, the estimated prevalence of OAG is 2.1% [95% confidence interval (CI) 1.7 to 2.5], ranging from 0.3% in people aged 40 to 3.3% in people aged 70 years. Incidence ranges from 30 to 181 per 100,000 person-years for ages 50 and 70 years, respectively. Of an estimated half a million people affected, 67% are undetected. Several risk factors are identified; for ages 40–75 years, prevalence estimates are: people with myopia 2.7%, people with diabetes 3.3% and family history in a first-degree relative 6.7%. The risk is four times higher among those of African ethnicity. Insufficient data were available to estimate prevalence in other ethnic minority groups in the UK.

Most potential screening tests reviewed had an estimated specificity of 85% or higher. No test was clearly most accurate, with only a few, heterogeneous studies for each test.

No randomised controlled trials (RCTs) of screening were identified. Based on two treatment RCTs, early treatment reduces the risk of progression (hazard ratio 0.65, 95% CI 0.49 to 0.87). Extrapolating from this, and assuming accelerated progression with advancing disease severity, without treatment the mean time to blindness in at least one eye was approximately 23 years, compared to 35 years with treatment.

The main determinant of cost-effectiveness was prevalence. Prevalence would have to be about 3–4% in 40 year olds with a screening interval of 10 years to approach cost-effectiveness. It is predicted that screening might be cost-effective in a 50-year-old cohort at a prevalence of 4% with a 10-year screening interval. General population screening at any age, thus, appears not to be cost-effective. Selective screening of groups with higher prevalence (black ethnicity and family history) might be worthwhile, although this would only cover 6% of the population. Extension to include other at-risk cohorts (e.g. myopia and diabetes) would include 37% of the general population, but the prevalence is then too low for screening to be considered cost-effective.

Screening using a test with initial automated classification followed by assessment by a specialised optometrist, for test positives, was more cost-effective than initial specialised optometric assessment. The cost-effectiveness of the screening programme was highly sensitive to the perspective on costs (NHS or societal). In the base-case model, the NHS costs of visual impairment were estimated as £669. If annual societal costs were £8800, then screening might be considered cost-effective for a 40-year-old cohort with 1% OAG prevalence assuming a willingness to pay of £30,000 per quality-adjusted life-year. Of lesser importance were changes to estimates of attendance for sight tests, incidence of OAG, rate of progression and utility values for each stage of OAG severity. Cost-effectiveness was not particularly sensitive to the accuracy of screening tests within the ranges observed. However, a highly specific test is required to reduce large numbers of false-positive referrals.

The findings that population screening is unlikely to be cost-effective are based on an economic model whose parameter estimates have considerable uncertainty. In particular, if rate of progression and/or costs of visual impairment are higher than estimated then screening could be cost-effective.

Conclusions

Implications for healthcare

Screening for OAG met the UK NSC criteria for condition and treatment, but not for test or screening. Population screening is not cost-effective, but targeted screening of high-risk groups may be. Measures systematically to identify those at risk and quality assure the programme would be required. Adequate service provision for those screened positive would be needed.

Glaucoma detection can be improved by increasing attendance for eye examination, and improving the performance of current testing by either refining practice or adding in a technology-based first assessment, the latter being the more cost-effective option. This has implications for any future organisational changes in community eye-care services.

Implications for research

Further research should aim to develop and provide quality data to populate the economic model, by undertaking the following, in order of priority.

First, a feasibility study of interventions to improve detection; input from qualitative researchers, health economists, health psychologists and trialists is required to evaluate components of the care pathway:

- optimal test strategy
- acceptability of interventions to improve attendance and the acceptability of subsequent testing
- harms and benefits associated with enhanced glaucoma detection strategies.

Secondly, a refinement of the parameter estimates in the economic model. In particular, further data on costs of blindness, risk of progression and health outcomes are required. A value for information analysis would inform where primary research should be directed.

Thirdly, an RCT of interventions to improve the uptake of glaucoma testing, informed by the results of the prior feasibility studies.

Publication

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NIHR Health Technology Assessment Programme

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The research reported in this monograph was commissioned by the HTA Programme as project number 04/08/02. The contractual start date was in February 2005. The draft report began editorial review in June 2006 and was accepted for publication in April 2007. As the funder, by devising a commissioning brief, the HTA Programme specified the research question and study design. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors' report and would like to thank the referees for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report.

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