Population based glaucoma screening

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Chapter 9

Summary

Glaucoma is a common eye disease that causes glaucomatous optic neuropathy with subsequent visual field loss, and can eventually lead to irreversible blindness. Early stages do not cause any symptoms, and visual field loss often goes unnoticed initially. Patients become aware of their eye disease only after extensive damage has occurred. Therefore, screening seems a logical approach to reduce the glaucoma burden. At present, a glaucoma screening programme does not exist in the Netherlands, but opportunistic case finding by ophthalmologists, optometrists, and opticians has become common practice. Despite case finding, about half of all glaucoma cases are currently undetected and thus do not receive any treatment or monitoring. Population based screening could help identify these individuals.

Wilson and Jungner proposed a set of criteria for appraising the validity of a screening programme. Chapter two (literature review) provides an overview of relevant literature regarding different aspects of glaucoma screening based on these criteria. Most of the criteria are satisfied; characteristics of glaucoma which make it suitable for screening are: glaucoma is a common disease and a leading cause of blindness, the detectable preclinical phase is long in glaucoma; early treatment is advantageous; diagnostic tests are non-invasive and do not use ionizing radiation; and finally, preventing blindness has a large beneficial effect on quality of life. Problems identified in the literature review are mainly related to the cost-effectiveness of glaucoma screening, which is dubious at best.

Chapters three and four assess the diagnostic performance of the Frequency Doubling Technology perimeter (FDT), a device suitable for glaucoma screening. In chapter three, FDT screening mode is compared to full-threshold mode. Both modes perform similar in terms of by-patient sensitivity and specificity, but they require a different cut-off point: one or more missed points in screening mode is equivalent to two or more missed points in full-threshold mode. For the screening mode, we found a sensitivity of 91% and a specificity of 88%. For the full-threshold mode, we found a sensitivity of 91% and a specificity of 83%. Both modes had an area under the receiver operating characteristic curve of 93%. Chapter four explores several strategies to improve the diagnostic specificity of the FDT. Confirming an abnormal FDT test result with a repeat test yielded a specificity increase from 80% to 90%, at the expense of some loss of sensitivity to early but not to moderate or severe glaucoma. Combining several FDT parameters from a single test or combining FDT parameters with GDx Nerve Fiber Analyzer parameters did not yield any noticeable increase in diagnostic performance.

Glaucoma screening by opticians is a potential alternative to population based screening. An important prerequisite is that the population at risk for glaucoma must visit an optician sufficiently frequent. In chapter five, the optician visiting frequency of Dutch inhabitants over age 40 is determined by questionnaire.

Response rate was 80% (959 of 1200 inhabitants) and 80% of responders had visited an optician during a five year period. Another prerequisite is willingness of opticians to participate in a glaucoma screening programme. A second questionnaire was sent to 50 opticians, 37 of whom responded, and 91% of responders expressed willingness to participate in an extended glaucoma screening programme (i.e. more extensive than tonometry).

In chapter six, the additional yield of a periodic glaucoma screening programme compared to current opportunistic case finding is estimated. Part of the incident glaucoma cases identified by the Rotterdam Study were found to have also been detected by regular ophthalmic care outside the study, whereas other cases had remained undetected during the entire follow-up interval. Twenty-three cases (29%) had already been detected, 55 cases (71%) remained undetected. The severity of glaucoma was worse in detected cases compared to undetected cases (P=0.009). The additional yield of screening is therefore lower than would be expected from prevalence data: we estimated that only about one in 1000 screened individuals could be saved from bilateral end-stage glaucoma.

In chapter seven, supra-threshold perimetry (STP) is compared to full-threshold standard automated perimetry (SAP). Because of extensive clinical experience with SAP, glaucoma severity can be assessed adequately by quantitatively relating the number missed points on STP to the SAP mean deviation (MD). Results show a linear relationship between the number of missed points on STP and the SAP MD with a correlation coefficient of -0.92. The MD can be estimated from the STP score by multiplying the number of missed points by -0.75. STP was nearly twice as fast as SAP. STP appears to be a fast and reliable method for estimating the severity of glaucomatous damage.

Whether or not a population based screening programme should be introduced in the Netherlands is discussed in chapter eight (general discussion). Cost-effectiveness studies regarding glaucoma screening indicate that economic viability is dubious. In this thesis, several factors are identified that have a further negative impact on the cost-effectiveness of glaucoma screening. These factors are: lengthbias, suboptimal by-patient test specificity, and large clinical workload from false positives. This leads to the conclusion that at present population based glaucoma screening is not feasible in the Netherlands. Optician based screening is a promising alternative, and will be subject of further research projects.