Surveillance for ocular hypertension: an evidence synthesis and economic evaluation


CRD summary
The review concluded that the non-contact tonometer and the handheld applanation tonometer seem to achieve a measurement close to the Goldmann applanation tonometer for measuring ocular hypertension but there was substantial variability in measurements both within and between studies. These conclusions reflect the evidence presented and appear likely to be reliable.

Authors’ objectives
To compare the agreement of tonometers used in clinical practice (for measuring ocular hypertension), using GAT (Goldmann applanation tonometry) as the reference tonometer. Evaluations were also made of risk prediction tools and preferences for different monitoring strategies (details beyond the scope of this abstract).

Searching
MEDLINE, EMBASE, Science Citation Index, BIOSIS and Cochrane Central Register of Controlled Trials (CENTRAL) were searched from 1987 to February 2010 for studies in English. Website of key journals were screened for further relevant or in-press publications. Research registers and trials registries were searched. Conference proceedings were excluded. Reference lists of included studies were searched.

Study selection
Direct comparative studies that assessed the agreement of one or more tonometers available for clinical practice with the reference standard tonometer (GAT) in the same group of people were included. Adults (>16 years) including those with a diagnosis of ocular hypertension or glaucoma or representative of the general population were eligible.

Studies were conducted in a wide range of locations (nine were UK studies). Patient demographics and types of tonometer used varied widely across studies. Studies involved healthy people, people with glaucoma or ocular hypertension or mixed populations. Eight types of tonometer were compared with the reference standard.

Two reviewers independently selected studies for inclusion. Disagreements were resolved by discussion or by a third reviewer.

Assessment of study quality
Study quality was assessed by two reviewers independently using a modified version of the QUADAS tool. Studies were classified as low quality if they did not meet one or more of the criteria. Disagreements were resolved by discussion or by a third reviewer.

Data extraction
Two reviewers independently extracted agreement data in order to calculate mean differences in intraocular pressure with 95% confidence intervals, 95% limits of agreement (LoA) and 95% prediction intervals.

Methods of synthesis
Summary mean differences were calculated using a random-effects model. Limits of agreement were calculated from the summary mean differences and associated random error. The proportion of results within 2mmHg of GAT was calculated. Heterogeneity was assessed by visual inspection of forest plots and by calculating tau and I² statistics. Possible causes of heterogeneity were explored through prespecified clinical factor subgroup analyses. Sensitivity analyses examined use of a fixed-effect model, exclusion of low quality studies, exclusion of studies with data clustered within persons and imputation of correlations using the minimum correlation coefficient reported from the studies assessing the same tonometer.

Results of the review
One-hundred-and-two studies (11,582 participants) were included; six were randomised controlled trials. All studies described participant selection and most studies accounted for all participants but the reporting was unclear in many studies for the other quality criteria.

The non-contact tonometer had the smallest difference compared to GAT (0.2mmHg, 95% LoA -2.9 to 6.5; 26 studies) and the Ocuton S tonometer had the largest difference (2.7mmHg, 95% LoA -4.1 to 9.6; three studies). For most tonometers the limits of agreement ranged from at least 4mmHg less to 4 mmHg more. The non-contact tonometer and the handheld applanation tonometer had the lowest expected random error and the Ocuton S the largest random error. All I² values were greater than 80%. Sensitivity analyses did not affect the results substantially.

Further results were reported.

Cost information
A systematic review of economic evaluations of ocular hypertension surveillance programmes and an economic evaluation of surveillance pathways for individuals with ocular hypertension were reported.

Authors’ conclusions
The non-contact tonometer and the handheld applanation tonometer seemed to achieve a measurement close to the Goldmann applanation tonometer but there was substantial variability in measurements both within and between studies. The findings cast doubt on the validity of the Goldmann applanation tonometer as the default standard.

CRD commentary
The review addressed a clear question and was supported by reproducible eligibility criteria. Several relevant electronic databases were searched. The restriction to searching only for studies published in English meant that some relevant studies may have been missed (and the review may have been subject to publication or language bias). Suitable methods were used to minimise the possibility that reviewer error and bias could affect the review processes.

The study quality assessment results were used appropriately for interpreting the results of the review. Study details were provided in an appendix. Appropriate methods were used to pool data and to assess and investigate heterogeneity.

The authors’ conclusions were suitably cautious in reflecting the limited evidence available and appear likely to be reliable.

Implications of the review for practice and research
Practice: The authors stated that consistent use of the same tonometer during clinical follow-up was arguably almost as important as choice of tonometer.

Research: The authors stated a need for better reporting of studies and a study of factors that could influence pressure measurements. They recommended further evaluation of the Goldmann applanation tonometer as the default tonometer in clinical practice.

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