Summary and Conclusions

Open Angle Glaucoma – Diagnosis, Follow-up, and Treatment

A Systematic Literature Review

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Summary and Conclusions of the SBU Report:

Open Angle Glaucoma – Diagnosis, Follow-up, and Treatment

A Systematic Literature Review

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SBU's Conclusions

This section summarizes the findings from SBU's assessment of diagnosis, follow-up, and treatment of chronic, open angle glaucoma and elevated intraocular pressure (ocular hypertension, OH). Glaucoma is a disease affecting the optic nerve, leading to visual field defects. The causes of glaucoma are not fully understood, but elevated intraocular pressure is the most important risk factor. Diagnosis involves examining the visual field, optic disc, and retinal nerve fiber layer. Although intraocular pressure is also measured, it is not part of the diagnostic definition of glaucoma. All treatment strategies aim at reducing intraocular pressure to delay progression of the disease.

Diagnosis

Visual field testing (perimetry)

- ❑ New testing methods (SITA tests for the Humphrey perimetry) yield high diagnostic accuracy for glaucoma and take approximately half the time of previous tests (Limited scientific evidence: Evidence Grade 3).

Examination of the optic nerve and retina

- ❑ In assessment of the optic disc, mono- or stereophotographs yield low to moderately high diagnostic accuracy (Limited scientific evidence: Evidence Grade 3).

- ❑ In examination of the optic disc, scanning laser tomography (Heidelberg tomography) is equal or superior to expert judgement as regards the ability to distinguish normal discs from those affected by glaucoma (Limited scientific evidence: Evidence Grade 3).

- ❑ In examination of the retinal nerve fiber layer, scanning laser polarimetry (the newer GDx instruments) and optical coherence

tomography (Stratus OCT) yield moderately high and approximately equal diagnostic accuracy (Limited scientific evidence: Evidence Grade 3).

Treatment

- ❑ In manifest glaucoma, treatment to reduce intraocular pressure delays the progression of visual field loss (Limited scientific evidence: Evidence Grade 3).

- ❑ In individuals with elevated intraocular pressure (ocular hypertension), treatment that lowers the intraocular pressure by 20%, or more, reduces the risk for developing manifest glaucoma in the treated eye (Limited scientific evidence: Evidence Grade 3). This effect has not been demonstrated when the reduction in intraocular pressure is less than 20%.

- ❑ No conclusive evidence shows whether surgical or laser treatment strategies are more effective than medical treatment (topical eye drops) in lowering intraocular pressure (Contradictory scientific evidence).

Ethical and Social Aspects

- ❑ Due to the slow course of glaucoma and the relatively high age of patients, there is a risk that examination and treatment are given low priority. Hence, special attention should be directed at assuring that the needs for diagnosis, follow-up, and treatment are met among these patients.

Health Economics

- ❑ No conclusive evidence shows which methods of diagnosis, follow-up, and treatment for glaucoma are the most cost effective (Insufficient scientific evidence).

Facts 1 Study Quality and Relevance, Evidence Grade.

Study quality and relevance refers to the scientific quality of a particular study and its ability to reliably address a specific question.

Evidence Grade refers to the total scientific evidence for a conclusion.

Evidence Grade 1 – Strong Scientific Evidence
A conclusion assigned Evidence Grade 1 is supported by at least two studies with high study quality and relevance among the total scientific evidence. If some studies are at variance with the conclusion, the Evidence Grade may be lower.

Evidence Grade 2 – Moderately Strong Scientific Evidence
A conclusion assigned Evidence Grade 2 is supported by at least one study with high study quality and relevance, as well as two studies with medium study quality and relevance, among the total scientific evidence. If some studies are at variance with the conclusion, the Evidence Grade may be lower.

Evidence Grade 3 – Limited Scientific Evidence
A conclusion assigned Evidence Grade is supported by at least two studies with medium study quality and relevance among the total scientific evidence. If some studies are at variance with the conclusion, the Evidence Grade may insufficient or contradictory.

Insufficient Scientific Evidence
If no studies meet the study quality and relevance criteria, the scientific evidence is rated as insufficient to draw any conclusions.

Contradictory Scientific Evidence
If different studies are characterized by equal study quality and relevance but generate conflicting results, the scientific evidence is rated as contradictory and no conclusions can be drawn.

SBU's Summary

Background and Purpose

Chronic, open angle glaucoma is a disease affecting the optic nerve and involves slowly progressing visual field defects. Glaucoma usually affects older individuals and is uncommon before 50 years of age. Between the ages of 65 and 75 years the prevalence of glaucoma is 5% to 6%. Around half remain undiagnosed. In Sweden, approximately 100 000 people are estimated to have diagnostically verified glaucoma. The disease presents no early symptoms. Hence, its impact on quality of life can be relatively insignificant for a long period. The risk of blindness in a person with glaucoma is 6% to 15%. Second to cataract, glaucoma is the most common cause of blindness.

Many people are at higher risk for developing glaucoma, e.g., those with elevated intraocular pressure but no glaucoma damage (ocular hypertension), those with exfoliation syndrome (protein deposits in the anterior lens capsule), or those having close relatives with glaucoma. Ophthalmology services in Sweden follow some of these individuals and provide treatment to some with elevated intraocular pressure.

Knowledge about the cause of open angle glaucoma is incomplete. The disease is defined as an optic nerve disorder that usually follows a slowly progressive course and where elevated intraocular pressure is the most important risk factor for developing a visual disability. The disease is diagnosed and monitored by identifying damage in the optic disc, retinal nerve fiber layer, and visual field.

All treatments currently offered – pharmacotherapy, laser therapy, and surgery – aim at reducing intraocular pressure. The number of pressure-reducing drugs has increased substantially, but their treatment effects have been called into question. Clinical studies published in recent years show that reducing intraocular pressure delays the onset of manifest glaucoma and reduces the risk for developing glaucoma in individuals with ocular hypertension. This, in combination with the introduction of several new diagnostic methods, has generated intensive discussion concerning the management of glaucoma.

Practice varies widely as regards the choice of treatment method. This is reflected by the wide variations among county councils in their utilization rates of different treatments. The direct annual costs for glaucoma-related health services, including the cost for visits to ophthalmologists and other categories of staff, was estimated at 600 to 700 million Swedish kronor (SEK) in 2006.

In the spring of 2004, SBU decided to assess the diagnosis and treatment of glaucoma. The project aimed to identify the scientific evidence behind different methods of diagnosing and treating glaucoma.

Scope and Issues

The scope of this project was limited to chronic, open angle glaucoma, i.e., primary open angle glaucoma including exfoliation glaucoma (also called capsular glaucoma) and normal tension glaucoma (open angle glaucoma without elevated pressure). Combined, these disorders account for approximately 90% of the glaucoma cases in Sweden. Secondary glaucoma, angle closure glaucoma, and congenital glaucoma have not been addressed.

The project did not address the issue of screening. An international project is investigating glaucoma screening, and a probable outcome is that more studies on mass screening for glaucoma will be required to determine the appropriateness of this type of screening.

Questions

Diagnosis and Follow-up

- Which of the methods commonly used today for visual field testing and diagnostics of the optic disc and nerve fiber layer are the most effective in diagnosing and following up glaucoma?
- Can recently introduced methods provide more accurate diagnosis and/or better follow-up?
- How do the results of visual field testing compare to the results of examining optic disc topography or the retinal nerve fiber layer?
- What evidence is available on the cost effectiveness of the different diagnostic methods?

Treatment

- Does treatment to reduce intraocular pressure have an effect on the course of disease in regard to patients' visual function and quality of life?
- Does the type of pressure-reducing treatment affect the outcome?
- Does the presence of pseudoexfoliations (protein deposits on the anterior lens capsule) affect the outcome of treatment?

- Can other treatments not primarily aimed at reducing intraocular pressure favorably affect the course of disease?
- What evidence is available on the cost effectiveness of the different treatment methods?

Report Contents and Target Groups

This report presents the findings of the systematic literature review concerning the diagnosis, follow-up, and treatment of open angel glaucoma. Chapter 2 describes the methodology used. Chapters 3 and 4 present the results of the literature review covering different diagnostic and treatment methods. The economic literature addressing the cost effectiveness of different methods is presented along with other literature on diagnosis and treatment. Chapter 5 summarizes the literature covering the quality-of-life effects of glaucoma and the methods used to measure this. Chapter 6 discusses ethical and social aspects of diagnosis and treatment of glaucoma. Chapter 7 presents current practices in glaucoma care, and discusses conceivable changes in practice given the findings of the literature review. The report concludes in Chapter 8 with a presentation of knowledge gaps and urgent needs for future research.

The report is intended to provide evidence to select healthcare methods for diagnosing, following up, and treating glaucoma. It targets healthcare staff, health policy makers, and administrators in decision-making positions.

Systematic Literature Review – Methods

Initially, the Cochrane Library was searched to determine the access to systematic reviews addressing the questions listed above. Thereafter, searches were conducted in PubMed and other databases relevant to the different questions.

Inclusion and exclusion criteria

Diagnosis and follow-up

1. The study should address diagnostic capabilities in open angle glaucoma and/or progression of ocular hypertension or glaucoma.
2. Some type of comparison should be available.
3. There should be at least 25 individuals per group, or 25 who are compared with the reference method.
4. Diagnostic definitions should be clearly described and comply with accepted reference standards.
5. The study design should not have any serious flaws.
6. Sensitivity and specificity (or corresponding parameters) should be reported.

Treatment

1. The study should address open angle glaucoma/ocular hypertension.
2. Comparison with a control group should be available.
3. Follow-up time should be at least 2 years.
4. Each group (treatment and control) should have at least 25 patients.
5. Diagnostic definitions should be clearly described.
6. Outcome measures can be: visual field, quality of life.

Quality Assessment and Evidence Grading

Two reviewers, independently, read the structured abstracts of articles retrieved from the database search to determine if the articles met the inclusion criteria. All studies found to be relevant by a reviewer were studied further in full text format by the same reviewers, independently, again with respect to the inclusion criteria. Articles that either of the reviewers found to be relevant were then studied thoroughly by two individuals (one of the previous

reviewers and another individual), independent of each other, to assess how well the studies met the predetermined quality criteria. Based on this information, the reviewers determined the strength (quality and relevance) of the study, rating it as high, medium, or low. Finally, tables were constructed to summarize the important facts from the studies rated as having high or medium quality and relevance.

For each question, the results of the studies were weighed in formulating conclusions, which were graded as follows:

- **Strong scientific evidence** (Evidence Grade 1)
- **Moderately strong scientific evidence** (Evidence Grade 2)
- **Limited scientific evidence** (Evidence Grade 3).

Studies that do not meet the above standards are classified as having insufficient scientific evidence. A contradictory finding among studies, which cannot be explained by the patient data or study design, reduces the evidence grade (see Facts 1).

Quality-of-life studies

Only a few clinical studies have used *quality of life* as an outcome measure in glaucoma treatment. However, many studies were found to use various instruments in attempting to address how glaucoma affects patients' quality of life. Studies of this type, however, do not answer the questions addressed by the project. Hence, these studies have not been reviewed and appraised in the same way as the other articles, and they are not included in the tables.

Economic studies

Searching and reviewing the economic literature followed basically the same process at that described above. For inclusion, the studies needed to address both costs and effects, be relevant to

Swedish conditions, and include comparisons with the best alternative. Two reviewers (ophthalmologist and health economist) independently assessed quality using SBU's checklist for economic studies.

Diagnosis and Follow-up

Background

On average, intraocular pressure is higher in glaucoma patients than in healthy patients. The risk for glaucoma increases rapidly as intraocular pressure increases. For many years glaucoma was diagnosed primarily by measuring intraocular pressure (tonometry). However, population studies found that many patients diagnosed with glaucoma had normal intraocular pressure (normal tension glaucoma). Concurrently, it was found that elevated intraocular pressure without other signs of glaucoma was common. Many studies later showed that most patients with elevated intraocular pressure did not develop glaucoma, even after lengthy follow-up periods.

Given this data, it became obvious that a glaucoma diagnosis could not be based solely on tonometry. For many years, diagnosis has required identifying vision damage caused by glaucoma: visual field defects or damage to the optic disc or retinal nerve fiber layer. Intraocular pressure is no longer included in definitions of glaucoma. Hence, this project has not assessed the various types of tonometry.

Glaucoma causes visual field defects already in early stages of the disease, while visual acuity is affected much later. Patients do not notice visual field defects before they become larger or approach the center of the visual field. Hence, visual field testing is used in diagnosis and follow-up, constituting the most important type of vision function exam for these patients. The defects that appear in the field of vision are a consequence of damage to the optic disc and the retinal nerve fiber layer. In addition to being

revealed by perimetry, glaucoma damage can also be detected with the help of an ophthalmoscope or a fundus lens during the clinical examination. Damage can also be detected in photographs of the optic disc or nerve fiber layer. In the past 15 years, it has also become possible to use computerized imaging to measure the topography of the optic disc or the thickness of the nerve fiber layer.

Hence, the diagnosis and follow-up of glaucoma is largely technology-dependent. The methods reviewed are presented in Facts 2.

Results of the literature review

In total, 82 studies were found to have sufficient quality to provide a foundation for conclusions on diagnosis and follow-up. The new SITA programmes for the Humphrey perimetry have high sensitivity and specificity in diagnosing glaucoma and substantially shorten the time needed for testing (Evidence Grade 3). Modern studies do not support the previously common perception that selective perimetry, particularly short wavelength automated perimetry (SWAP), and the frequency doubling technique (FDT) enable earlier diagnosis than does common, standard automated perimetry (SAP) (Evidence Grade 3).

The frequency doubling technique has moderately high sensitivity, but it usually has high specificity when used to identify eyes with visual field defects detected by SAP. However, diagnostic accuracy is poor in the early stages of the disease. Screening and threshold programmes appear to be equivalent, but the screening programmes are considerably faster. The scientific evidence is insufficient to draw conclusions regarding high resolution perimetry, rarebit microdot perimetry, and flicker perimetry.

Considerably fewer studies are available on follow-up than on diagnosis. The area is considered to be insufficiently researched. Methods based on detecting localized defects appear to be more effective than methods that also include diffuse visual field loss.

Facts 2 Methods Reviewed.

Visual field testing (perimetry)

- SAP – Standard automated perimetry performed via the following testing programmes:
  - Humphrey: Full Threshold, SITA Standard and SITA Fast, and supraliminal screening programmes
  - Octopus: Full Threshold, TOP, and supraliminal screening programmes
- SWAP – Short Wavelength Automated Perimetry, also known as blue-on-yellow perimetry or blue-yellow perimetry, conducted via the following testing programmes:
  - Humphrey: Full Threshold SWAP, SITA SWAP
  - Octopus: Full Threshold SWAP
- FDT – Frequency Doubling Technique, also known as Frequency Doubling Perimetry (FDP)
  - Older instrument using 16 to 18 large test fields. Threshold and screening programmes
  - New instrument Matrix with 54 smaller test fields
- HRP – High Pass Resolution Perimetry, also known as ring perimetry
  - One instrument and one programme
- Rarebit Microdot Perimetry
  - One programme
- Flicker perimetry in the Octopus perimeter

Examination of optic disc and retinal nerve fiber layer

Optic disc appearance:

- Photo – Traditional photographic methods or digital photography, stereo and mono
- SLT – Scanning Laser Tomography
  - Instrument: Heidelberg Retinal Tomograph (HRT) is available in several models (I, II, and III) that yield similar results. TOPS is a somewhat similar instrument, but no longer in production
- OCT – Optical Coherence Tomography

Retinal nerve fiber layer (RNFL):

- Photo – Traditional photographic methods or digital pwhotography
- SLP – Scanning Laser Polarimetry
  - GDx Nerve Fiber Analyzer. Three models are available: the newer variable corneal compensator (VCC) has been reviewed. The older model, with the fixed corneal compensator (FCC) was not reviewed since it is known to have serious flaws. No scientific evidence is available for the most recent model, with enhanced corneal compensator (ECC).
- OCT – Optical Coherence Tomography
  - Two models, the newer (Stratus) has better resolution. Both instruments were reviewed.
- RTA – Retinal Thickness Analyzer

Standard automated perimetry (SAP) is probably better suited than SWAP for follow-up, since test-retest variability and the sensitivity for cataracts is much greater with SWAP than with SAP. In its original form, FDT would not be particularly well suited for follow-up since the test stimuli are so great that the test often misses a limited spread of defects present.

When evaluating *optic disc topography,* traditional classification of optic disc photographs by experts generally yields low to moderately high diagnostic accuracy (Evidence Grade 3). Direct comparisons by modern methods, based on computerized image analysis, have shown the diagnostic accuracy of the different methods to be similar.

Studies have extensively documented scanning laser tomography involving the Heidelberg instrumentation (HRT). Moderately high diagnostic accuracy is usually achieved. When eyes classified as *borderline* (according to HRT's normal Moorfields classification) are classified as healthy, then the method is relatively insensitive but has high specificity. When borderline eyes are classified as abnormal, then sensitivity increases but specificity decreases substantially. HRT does not work as well in eyes with small optic discs. Optical coherence tomography (OCT) has been used in only a few studies of optic disc topography. In a well-executed study, HRT's diagnostic accuracy was superior to that achieved by expert analysis of stereo photographs. However, another study showed contradictory results.

The *retinal nerve fiber layer* (RNFL) has been used less than optic disc topography in diagnosing glaucoma. Visualization of the layer is difficult in clinical examination, particularly in patients with only light pigmentation in the fundus. Although it has been available for several decades, RNFL photography has never been widely applied as a clinical method.

Currently, OCT (Humphrey Stratus OCT instrument) or laser polarimetry (GDx instrument) are used in diagnosing the nerve fiber layer. Studies of OCT have indicated a moderately high or

occasionally low diagnostic capacity. One study reported OCT to perform better than RNFL photography. In another study, expert analysis of stereo photography performed better. OCT yielded a more accurate diagnosis if one used peripapilliary measurements (in the area around the papillae) than if one measured the macular area. No distinct differences in performance were found among the various measurement protocols – with different numbers of measurement points and resolution. OCT yielded more accurate results than RNFL photographs, but less accurate results than stereo photographs of the nerve fiber layer.

Treatment

Background

Reducing intraocular pressure has long been the established treatment principle for open angle glaucoma. Primary treatment usually involves medication delivered as eye drops. Laser therapy is used both as primary treatment and when local therapy does not yield satisfactory reduction in pressure. As a rule, surgery is used when eye drops and laser therapy do not satisfactorily reduce pressure, even when used together.

Over the years, many different types of pharmaceuticals have been shown to reduce intraocular pressure. Six classes of glaucoma medication are currently available, all of which are delivered as eye drops for local treatment and work either by reducing the formation of aqueous humor or by facilitating its outflow. Modern eye drops usually have no, or only minor, side effects. Prostaglandin analogs usually have no general side effects, but may cause iris pigmentation or eyelash growth. Beta-receptor blockers are almost completely free of local irritation, but cannot be given to asthma patients. Also, these agents can reduce the pulse rate and may cause nightmares or depression. The drugs used most commonly in the past, eg, pilocarpin, are seldom used today since they had substantial side effects, such as small pupils with poor night vision and nearsightedness.

Filtering eye surgery was introduced in the early 1900s, and when surgical microscopes came into use during the late 1960s modern techniques in glaucoma filtering surgery (trabeculectomy) developed. This operation involves creating a drainage opening to allow fluid (aqueous humor) to drain from the eye. The surgery has been further refined, mainly by attempting to prevent closure of the filtering bleb through local antifibrotic treatment, inserting shunts, and nonpenetrating surgery. Trabeculectomy remains the dominant surgical procedure for open angle glaucoma in Sweden. Closure of the filtering bleb and development of cataract are common complications following filtration surgery. Postoperative infections are less common, but can lead to substantial deterioration or loss of vision.

In addition to invasive surgery and eye drops, intraocular pressure can also be reduced by laser treatment of the trabecular meshwork, ie, trabeculoplasty (LTP). Laser treatment can improve the drainage of aqueous humor. Although this treatment has few risks, its effect can decrease with time. Treatment may be followed by a transient increase in intraocular pressure and an inflammatory reaction that is usually mild and brief.

Alternatives to the treatment principle of reducing intraocular pressure have been actively discussed and research is in progress, mainly concerning drugs that could improve blood flow in the eye, or drugs that would have a neuroprotective effect on the retinal ganglion cells, thereby preventing cell death regardless of intraocular pressure. Currently, there are no drugs with proven effects on the disease course based on any of these modes of action.

Results of the literature review

Only 16 studies were found to be of sufficient quality. Eight studies (10 published articles) address the extent to which reducing intraocular pressure affects the course of disease. The effects of active drugs on the visual field and/or the optic nerve are compared with the effects of placebo or no treatment. Overall, the

studies support the perception that treatment to reduce intraocular pressure will delay the visual field loss in manifest glaucoma (Evidence Grade 3).

Treatment that lowers intraocular pressure by at least 20% reduces the risk of developing manifest glaucoma in eyes with elevated pressure (Evidence Grade 3). No such effect has been shown at a lesser reduction in intraocular pressure.

Two studies addressed the association between the level of reduction in intraocular pressure and effects on the visual field. Treatment effects were related to the level of reduction in intraocular pressure, and the risk for progression decreased by approximately 10% for each mmHg of reduction in intraocular pressure. However, the studies were not primarily designed to answer this question and cannot offer any solid conclusions.

Five studies attempted to compare the effects that different pressure-reducing treatment options had on visual field development. However, the scientific evidence is contradictory and offers no definite conclusions regarding the question of whether a particular form of pressure-reducing treatment is more effective than other forms of such treatment.

The scientific evidence is insufficient to determine whether the presence of pseudoexfoliations (protein deposits in the anterior lens capsule) influences the effectiveness of pressure-reducing treatment for open angle glaucoma. Finally, the scientific evidence was found to be insufficient to determine whether any forms of treatment not based on reducing intraocular pressure (eg, drugs that improve the blood flow in the eye or drugs with neuroprotective effects) affect the course of disease.

Quality of Life

Traditionally, studies of glaucoma treatment have largely focused on measuring intraocular pressure and visual field. From the patient's perspective, the impact on quality of life is particularly

important. Information concerning quality of life contributes toward more specific knowledge about the consequences of the disease.

Quality of life can be an important outcome measure in following up treatment results and can also contribute to the development of glaucoma care, eg, by including patient-staff interaction and other factors associated with the care environment.

The literature search identified only a few clinical studies that used *quality of life* as an outcome measure in treatment of glaucoma. However, many articles were found that used different measurement instruments in attempting to study the impact of glaucoma on a person's quality of life. Although these studies provide no answers to the project's questions concerning which type of treatment yields the best outcome, they can be of interest in describing what it means to have glaucoma.

Economic Aspects

No economic assessment studies were found concerning the diagnosis of glaucoma.

Many of the treatment studies in health economics compared different pressure-reducing drugs. The model analyses on which these studies were based were not always clearly described, making them difficult to evaluate. Consistently, a clear association was found between the outcome of the studies and the interests of the sponsors. Furthermore, most studies revealed methodological weaknesses of various types, eg, in the outcome measures used.

Hence, the conclusion drawn was that the scientific evidence is insufficient to determine which methods of diagnosis and treatment for glaucoma are the most cost effective.

Ethical and Social Aspects

It is important for healthcare staff to take a patient-focused approach that considers the patient's ideas, apprehensions, and expectations about glaucoma and its treatment. It is also essential to show respect for the patient's right to participate in treatment decisions as well as to decline treatment. Even patients with limited autonomy should have their preferences addressed and respected to the extent possible. If one goes against a patient's wishes, one must be able to motivate this and potentially involve the proxy decision-maker.

Since the disease progresses slowly and the patients are relatively old, there is a risk that examination and treatment are given low priority. Hence, particular attention should be given to assuring that these patients receive adequate diagnosis, treatment, and follow-up for their disease.

Practice

A survey of practices in glaucoma care was conducted within the project. Data were acquired from the annual report statistics of the Swedish Ophthalmological Society, sales statistics from Apoteket (the national pharmaceutical retailing monopoly in Sweden), and from a questionnaire sent to all ophthalmology departments and clinics (public and private) in Sweden. This survey suggests that practices vary widely, particularly as regards the use of drugs, laser treatment, and surgery. The practice variations have not decreased over time, nor does any evidence suggest that high utilization of a particular treatment method is offset by lower utilization of other methods. Explaining the causes behind these practice variations requires more sophisticated analyses, which have not been within the framework of this project.

Responses to the survey indicate substantial practice variations in managing the fictitious cases presented in the questionnaire. Nevertheless, in most cases there appears to be good compliance with existing clinical guidelines. A substantial deviation was noted, however, in the number of visual field tests performed and the number of optic nerve photographs. Current guidelines recommend 1 or 2 visual field tests per year in patients with stable glaucoma (and more for unstable glaucoma). According to the survey, less than half that many are actually performed. Even allowing for variations in the need for visual field tests during the course of disease, the current mean testing rate appears to be insufficient.

Against the background of the practice survey and the conclusions of the literature review, the following changes in practice would appear to be desirable:

- Increased number of visual field tests during the initial stages of disease
- More individualized care with a focus on early investigation of the disease course in the individual patient.

It should be possible to, at least partly, implement the suggested practice changes with available resources. The cost of these changes would be relatively limited. An increase in the number of visual field tests by, on average, one examination per year and patient with glaucoma would increase the cost of ophthalmology services by approximately 30 million Swedish kronor (SEK), assuming an average cost of SEK 300 per visual field test. This sum corresponds to 4% to 5% of the direct annual healthcare costs for glaucoma.

Knowledge Gaps, Future Research Areas

The systematic literature review has revealed major gaps in knowledge, and it has not been possible to answer all of the questions originally formulated in the project plan. The following questions/areas have been identified as particularly urgent topics for future research:

Diagnosis

- Which diagnostic methods are the most effective for early identification of glaucoma damage and the progression of manifest injuries?
- In most patients with glaucoma, the disease grows worse with time, but the rate of progression differs. It is essential to develop methods that quickly and precisely predict the rate of progression.
- Do functional tests (visual field tests) and structural parameters (optic nerve, retinal nerve fiber layer) measured by modern imaging methods yield comparable results? If so, there is no reason to use both types of examinations concurrently in following patients.

Treatment

- Can any treatment that is based on principles other than reducing intraocular pressure favorably affect the disease course in open angle glaucoma?
- Does the presence of pseudoexfoliations have any effect on the treatment results of pressure-reducing therapy?
- Are surgical and/or laser therapies more effective than pharmacotherapy?

Quality of Life

- It is essential to develop and validate standardized instruments, adapted to Swedish conditions, for measuring quality of life. Global instruments and also instruments specific to individuals with glaucoma are needed.

Economics

- The availability of economic studies concerning glaucoma is severely limited. Clearly, there is a need for producer-independent, economic studies that address different diagnostic and treatment methods for glaucoma.

Practice

- Further analysis is needed concerning the underlying causes of practice variations in glaucoma care. The consequences of these variations and the obstacles and opportunities that can influence practice are other urgent issues for future studies.

Reports *published by SBU*

SBU Reports in English

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Sickness Absence – Causes, Consequences, and Physicians' Sickness Certification Practice, Scandinavian Journal of Public Health, suppl 63 (2004), 167/suppl

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Bone Density Measurement, Journal of Internal Medicine, Volume 241 Suppl 739 (1997), no 127/suppl

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Radiotherapy for Cancer, Volume 1, Acta Oncologica, Suppl 6 (1996), no 129/1/suppl

Radiotherapy for Cancer, Volume 2, Acta Oncologica, Suppl 7 (1996), no 129/2/suppl

Mass Screening for Prostate Cancer, International Journal of Cancer, Suppl 9 (1996), no 126/suppl

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Literature Searching and Evidence Interpretation (1993), no 119E

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SBU Evaluates Health Care Technology

Below is a brief summary of the mission assigned to SBU by the Swedish Government:

- SBU shall assess healthcare methods by systematically and critically reviewing the underlying scientific evidence.
- SBU shall assess new methods as well as those that are already part of established clinical practice.
- SBU's assessments shall include medical, ethical, social and economic aspects, as well as a description of the potential impact of disseminating the assessed health technologies in clinical practice.
- SBU shall compile, present and disseminate its assessment results such that all parties concerned have the opportunity to take part of them.
- SBU shall conduct informational and educational efforts to promote the application of its assessments to the rational use of available resources in clinical practice, including dental care.
- SBU shall contribute to the development of international co-operation in the field of health technology assessment and serve as a national knowledge centre for the assessment of health technologies.

Open Angle Glaucoma – Diagnosis, Follow-up, and Treatment

SBU's report on chronic, open angle glaucoma builds on a systematic, critical review of the scientific literature in the field.

The report is one in a series of reports published by SBU (Swedish Council on Technology Assessment in Health Care).

This document presents the summary and conclusions of the full report, which has been approved by SBU's Board of Directors and Scientific Advisory Council.

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