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The Royal Australian
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Clinical Practice Guidelines for the Collaborative Care of glaucoma patients and suspects by ophthalmologists and optometrists in Australia

Approved by:
RANZCO Board

Next review:

17 August 2022

Approval date: 17
August 2019

The Royal Australian and New Zealand College of Ophthalmologists

ACN 000 644 404

94-98 Chalmers Street, Surry

Hills NSW 2010 Phone: +61 2

9690 1001 Fax: +61 2 9690

1321

www.ranzco.edu

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1. Purpose and Scope

Glaucoma is the most common cause of preventable but irreversible blindness in the world [1,2]. Delayed treatment risks irreversible vision loss. Management is complex and must be individualised for each patient.

The velocity of progression of progression of glaucoma is highly variable and changes over time [3]. Some patients progress sufficiently slowly that they will not be visually impaired over their lifetime even without medical or surgical treatment. Others may progress so fast that blindness may develop from advanced disease within 3 months of a routine visit at which the disease was stable.

Glaucoma is difficult to diagnose in its pre-perimetric stages. The number of Australians with examination findings suggestive of glaucoma but who do not have visual field defects is about equal to the number of those with established glaucoma and vision loss [4]. Although higher intraocular pressure is strongly associated with the presence and development of glaucoma [5] a large majority of people whose intraocular pressure is above the 95th population percentile do not develop glaucoma over 5 years. The proportion who do, however, continue to increase over time [6].

This means that a relatively large number of people who see an optometrist for an unrelated problem will have findings suggestive of glaucoma. In order to prevent unnecessary or ineffective episodes of care for those without glaucoma, and preventable progression in those with the disease, a definitive medical assessment is required followed by a detailed and personalised care plan based on the totality of the patient's situation, staging and risk.

Where medical resources are constrained such as in the Public Hospital System, patients at low risk of glaucoma progression or development may be seen less often than the preferred medical standard if the missing data is collected by that patient's optometrist and communicated to the ophthalmologist. This is the basis of Glaucoma Collaborative Care [7].

As long as the episode of care does not increase out of pocket costs, this may also be cost neutral for the patient and cost saving to the State Public Hospital Service. Where the visit coincides with a routine comprehensive optometric review, this may also be cost saving to Medicare.

These guidelines have been written to describe the current optimal care pathway for patients who have glaucoma or who need to be monitored for the development of it.

These guidelines do not:

- Address medico-legal implications of collaborative arrangements; all professionals entering into such arrangements should seek independent medical indemnity advice and have adequate insurance coverage.



- Seek to prescribe a ‘one size fits all’ approach to a broad spectrum of clinical situations. What works collaboratively in some locales might not be optimal in others. Flexibility in approaches should allow the patient’s interests to be upheld as the highest priority.

Where relevant, to provide the best evidence base, we have examined and cited the experience of established collaborative care schemes in Canada and the United Kingdom (UK). As the most prolific evidence is from the UK, it forms the bulk of evidence presented.

2. What is Collaborative Care for Glaucoma?

There are three different aspects to the collaborative interactions between ophthalmologists and optometrists in regard to optimal care in glaucoma:

- A pathway for an optometrist to refer a patient when they are concerned about the possibility of glaucoma during a routine optometric review which results in communication of the findings and care plan back to the optometrist.
- The communication of examination findings during an episode of routine optometric care (i.e. assessment for refraction and disease screening) that may enhance the care of a patient already under the care of an ophthalmologist.
- The delegation to optometrists of some part of the regular monitoring of patients with stable glaucoma or in whom glaucoma is thought to be likely to develop.

The first two aspects are not part of Collaborative Care. They are rather a core part of professional relations, providing a clear and demonstrable benefit to the patient and facilitating optimal medical care.

Collaborative Care for Glaucoma describes the last aspect and requires a specific plan created by the ophthalmologist and agreed to by both the patient and the optometrist.

3. Current barriers to Collaborative Care for Glaucoma

Evidence for the standards required for examination and treatment of patients with glaucoma is summarized in the NH&MRC Guidelines for the Screening, Diagnosis, Prognosis, Management and Prevention of Glaucoma 2010. [8]

Optometrist Practice

- Community optometrists’ self-reported practice in glaucoma detection may overestimate tests carried out on a routine basis, illustrating a disparity between best practice and average practice.[19]
- Optometrists participating in expanded roles such as care of glaucoma patients should be subject to audit to ensure that clinical governance standards are met and communications with general practitioners and ophthalmologists are of a sufficient standard.[20] Additional local feedback to improve referral accuracy has proved successful.[21]

Problems with Screening and Detection

- All the current technologies of visual function and optic nerve head/retinal nerve fibre layer measurements (i.e. function and structure) used to aid glaucoma diagnosis

have high false positive rates. Reliance on clinical testing for the diagnosis of glaucoma should not replace clinical acumen.

Perimetry

- Perimetry is unreliable as a screening test for glaucoma in unselected populations due to the very high false positive rate (approx. 20%) even using the simplest supra-threshold algorithms. [5]
- Achromatic perimetry using the Humphrey Zeiss: Humphrey Visual Field Analyzer (HFA, Carl Zeiss Meditec AG, Jena, Germany) is the 'gold' standard for functional testing. A variety of other perimeters is used widely, especially among optometrists. These include the Medmont perimeter (Medmont, Nunawading, Australia), Octopus (Haag-Streit, Köniz, Switzerland) and Frequency Doubling Technology (FDT, Carl Zeiss Meditec AG, Jena, Germany). Results from these machines are not directly comparable. Medmont perimetry requires a conversion algorithm to directly correlate with HVF results [23–25] and is generally 7 dB less sensitive. Correlation sensitivity is also nonlinear across the extent of the visual field.25 Octopus perimetry has a 13% mismatch in visual field points compared with HVF.[26] As FDT follows a flicker detection paradigm, it is not directly comparable with other perimetry. The diagnostic accuracy of a single reliable screening FDT test is poor even in a population at high risk for glaucoma [27]

Imaging

- Structural imaging of the optic nerve head also has a high false positive rate. Abnormalities on tomography scanning of the optic nerve head in Australians aged over 50 years have a false positive glaucoma detection rate of 30%. [28] Focal abnormalities of the retinal nerve fibre layer on spectral domain OCT scanning have a false positive rate of 35%. [22] In research studies, trained graders do not always agree on results from single imaging tests used to diagnose glaucoma [29, 31] Furthermore, each technology has its own analysis software which is not interchangeable between machines. In the absence of expert analysis, none of the current technologies for assessing structural changes of the optic nerve head is suitable for independent screening of patients for glaucoma.[29]

Tonometry

- Intraocular pressure is the most consistent risk factor for glaucoma prevalence and progression and must be measured accurately and reliably. All the studies from which our understanding of glaucoma risk and the effects of treatment are drawn have used Goldmann Applanation Tonometry (GAT) with calibrated, regularly checked tonometers.
- Noncontact tonometry (NCT), can be very inaccurate. A study of noncontact tonometers evaluated against a calibrated GAT exhibited mean errors of 0.5–2.9 mmHg. [32] The NCT significantly underestimates GAT measurements at lower IOP and overestimates these at higher IOP [33,34] although in thicker corneas, NCT systematically yields significantly higher readings than GAT.[6] Therefore, the error rates and the higher variability between tests makes NCT unsuitable for glaucoma diagnosis and monitoring, particularly in those with thicker corneas, and its values are not interchangeable with the measures made by ophthalmologists using GAT. Similarly, the differences between modern indentation tonometry and GAT preclude it from use as an objective method to measure IOP in normal adult eyes.[33] Experience from referral-refinement schemes for screening glaucoma in the UK suggest the majority of referrals for glaucoma suspicion for untrained optometrist were for raised IOP (>21 mmHg) measured by NCT with no measurement of corneal thickness, a known confounding factor (see earlier). Referral from trained optometrists utilising GAT, usually under the supervision of an ophthalmologist, resulted in a lower false positive rate, yet this was still approximately 50%. [35–38]

Corneal Thickness

- Corneal thickness has a complex relationship with the risk of glaucoma development and progression. It is both a confounder of tonometry as well as an independent risk factor for open angle glaucoma. IOP is significantly underestimated by GAT in thin corneas and overestimated in thick corneas and no externally validated nomogram for conversion exists. Reduced corneal thickness is a notable risk factor for conversion from ocular hypertension to glaucoma.[39] Risk stratification for IOP with glaucoma risk is based on the Ocular Hypertension Treatment Study and used in protocol-driven treatment programmes such as in the NICE GL85 clinical guidelines. [12]. However it is important to be aware that the effect of corneal thickness of individual patient risk varies. This is especially true for thick corneas where the tissue biomechanical characteristics matter more than CCT. There is an approximately 30-40% risk that if someone assumes that a thick cornea means overmeasurement of IOP, a patient will be falsely reassured when the intracameral IOP actually as high or higher than the GAT measurement.[30]

Stage of Glaucoma

- Early primary open-angle glaucoma is difficult to detect owing to the wide variation in normal optic disc structure, [40,41] IOP fluctuations [42] and variability in visual field testing. [43] Optic nerve assessment by the nonexpert is variable with a high false positive rate that is compounded by inaccuracies in IOP measurement. [38]

Testing Modalities

- There is no universal policy for testing. Some patients perform very poorly on visual field testing while others have unusual optic discs or very advanced glaucoma not amenable to many imaging modalities of the optic nerve.

Decisions about Interventions

- The decision to initiate treatment should not be made lightly because of the potential morbidity, costs for the patient and the community and because some will not suffer significant visual loss in their lifetime.
- While there is a subset of patients who require aggressive intervention, there are many who do not. It requires considerable skill to differentiate between these groups. [44]
- Even glaucoma specialist ophthalmologists cannot always be certain who is most at risk to progress over time on the basis of just an initial assessment. [45]
- Patients with glaucoma, suspected glaucoma and/or ocular hypertension require lifelong follow-up to monitor for disease onset or progression. Up to 25% of patients can continue to lose visual field despite treatment and close monitoring. [46] The same comments apply to the decision to accelerate treatment if progressive damage is suspected.
- Both initial diagnosis and identification of disease progression need verification by an ophthalmologist.

Specific Difficulties: Angle-closure

- Although fewer persons are affected globally compared with the open-angle glaucomas, those with angle-closure suffer approximately equal numbers of visual disability. [13]
- To minimize visual loss, those with angle-closure must be identified; treatment is different from the approaches to open-angle glaucomas. Such disease mechanism separation depends primarily on the clinical examination and particularly on the gonioscopy findings. Van Herick grading of angles, commonly performed by optometrists in place of gonioscopy, is not adequate to assess angle status. To detect an occludable anterior chamber angle (Van Herick's vs. gonioscopy), sensitivity, specificity and negative predictive values, they were 69, 88 and 94% respectively in a community screening scheme. [36] There is improved accuracy with



Pentacam (Oculus, Wetzlar, Germany) [47] and anterior segment OCT [46] but this is not common practice and unlikely to become so because of costs. As technology becomes more affordable, it may acquire a greater role.

- All eyes need to be assessed for the possibility of angle-closure; anyone thought to have angle-closure must be assessed by an ophthalmologist as the definitive management is surgical.

Special Difficulties: Normal-tension glaucoma

- Diagnosis of open-angle glaucoma patients with IOP within the usual range depends entirely on a knowledgeable assessment of the optic discs, with visual field testing as necessary. No one factor alone is diagnostic. [48]
- Assessment of the optic nerve in an Australian Study showed that glaucomatous optic discs was missed more frequently among optometrists than ophthalmologists. [49]

4. Goals of Interdisciplinary Collaborative Care

4.1 Collaborative Care for Glaucoma should:

- Be patient focused.
- Implement evidence-based healthcare.
- Provide the patient access to the most appropriate health-care provider in a timely fashion.
- Clearly define the roles for health-care providers and facilitate effective communication.
- Ensure tests and measures are appropriate and necessary.
- Reduce unnecessary health-care provider visits.
- Avoid under- or over-treatment of patients.
- Ensure patients have access to the full range of treatment alternatives of which they should be made fully aware.

5. Primary Prerequisite Skills and Equipment

All optometrists who participate in collaborative care schemes should have a certified competency and a detailed understanding of the following:

- What glaucoma is including the numerous varieties of glaucoma such as primary and secondary glaucomas (and the multiple causes thereof), open-angle and angle-closure glaucomas and normal-tension glaucoma.
- The systemic side effects of commonly prescribed drugs in glaucoma
- Systemic drugs which can precipitate or affect glaucoma.
- Potential interactions and potentiation between topical and systemic medications.
- Systemic diseases that can cause glaucoma and uveitis which in itself can cause secondary glaucoma.
- The role of nonmedical management of glaucoma – lasers, drainage surgery.

Optometrists should have at least the following examination skills and resources:

For screening and referral of a patient for whom an optometrist is concerned about the possibility of glaucoma during a routine optometric review.

- Snellen or Logmar acuity chart
- Stereoscopic slit lamp with diagnostic lenses to view the posterior segment and specifically assess the optic disc and retinal nerve fibre layer.



- Goldmann Applanation Tonometry (regularly checked and calibrated. Non-contact and indentation methods are NOT appropriate)
- Pachymetry
- van Herick angle assessment

For the communication of examination findings during an episode of routine optometric care (i.e. assessment for refraction and disease screening) that may enhance the care of a glaucoma patient already under the care of an ophthalmologist.

- Snellen or Logmar acuity chart
- Stereoscopic slit lamp with diagnostic lenses to view the posterior segment and specifically assess the optic disc and retinal nerve fibre layer.
- Goldmann Applanation Tonometry (regularly checked and calibrated. NCT is NOT appropriate)
- Fundus and optic disc photography to document the location of optic disc haemorrhages
- Gonioscopy

For Collaborative Care delegation to optometrists of some part of the regular monitoring of patients with stable glaucoma (equipment will depend on specific collaborative care plan)

- Snellen or Logmar acuity chart
- Stereoscopic slit lamp with diagnostic lenses to view the posterior segment and specifically assess the optic disc and retinal nerve fibre layer.
- Goldmann Applanation Tonometry (regularly checked and calibrated. NCT is NOT appropriate)
- Pachymetry
- Fundus and optic disc photography to document the location of optic disc haemorrhages
- Gonioscopy
- Visual field testing with Humphrey Field Analyzer with ability to export raw data for transfer to the ophthalmologist to ensure proper progression analysis.
- Spectral Domain Optical Coherence Tomography for optic disc/ retinal nerve fibre layer imaging for which a raw data export can be imported by the collaborative care ophthalmologist.

6. Risk Assessment of Patients without Glaucoma

On the basis of an examination by a healthcare provider, patients should be categorized on the following basis. The definitions are based on the Canadian Model for collaborative care [50].

Lower risk of developing glaucoma

There are many groups of people whose glaucoma risk is higher than the general population but could be considered relatively low. These patients are otherwise generally healthy with no history of eye trauma. There should be no visual field abnormality with achromatic perimetry. The optic nerve and nerve fibre layer appearance should be normal. IOP should be measured with Goldmann Applanation Tonometry. NCT is NOT acceptable. The risk factors include:

- IOP >21mmHg but <28mmHg with very thick cornea
- Family history of glaucoma
- History of blunt eye injury with no sequelae

Otherwise normal patients under the care of an optometrist with such isolated glaucoma risk factors should be regularly reviewed by them as needs dictate. The optometrist may refer the patient to an ophthalmologist for diagnosis, advice and management planning.

Higher risk of developing glaucoma

Higher glaucoma risk is categorized as per the lower-risk but with any of the following:

- IOP > 21 mmHg but < 25 mmHg with average central corneal thickness
- Isolated optic disc haemorrhage
- Pseudoexfoliation (PXF) without elevated IOP
- Pigment dispersion syndrome (PDS) without elevated IOP
- Increase in measured IOP over time by 50% or more
- Medications at risk of increasing IOP but without elevated IOP
 - Steroids
 - Antidepressants in patients with narrow iridocorneal angles (without angle closure)
 - Atypical antiepileptic drugs such as topiramate

Otherwise normal patients with isolated higher glaucoma risk factors should be regularly reviewed by an optometrist with a much lower threshold of referral to an ophthalmologist. Recurrent optic disc haemorrhages constitute multiple risk factors and move the patient into the very high-risk category.

Very high risk of developing glaucoma

Very high-risk patients will have:

- Multiple risk factors
- Elevated IOP associated with other causes of secondary glaucoma such as history of the medications listed above, eye trauma, pseudoexfoliation (PXF), pigment dispersion syndrome (PDS), uveitis, iris or angle neovascularization, but without clear signs of optic disc damage or visual field loss
- IOP > 27 mmHg
- IOP > 24 mmHg with average corneal thickness
- IOP > 21 mmHg with thin cornea
- On IOP lowering medications but with normal optic disc, nerve fibre layer and visual field and not under any form of care by an ophthalmologist.

Very high-risk patients will almost always require referral to an ophthalmologist and always if the risk categorisation is recent.

Glaucoma Suspect

These are patients who have examination findings suggestive of glaucomatous optic neuropathy such as rim notches or localised retinal nerve fibre layer defects (RNFL) defects but who have sufficient overlap with physiological variants to make diagnosis uncertain, or patients who have ocular examination findings not thought to be glaucomatous but a repeatable visual field defect characteristic of glaucoma. Glaucoma suspects can be further classified based on their risk of actually having glaucoma into Lower and Higher and Very High risk based on the schema above.



All patients who an optometrist classifies as glaucoma or glaucoma suspect should be referred to an ophthalmologist in order to refine the diagnosis and create a management plan. The urgency of the referral should reflect the degree of risk and/or the stage of glaucoma.

Stable early glaucoma

These patients have definite optic disc pathology and/or repeatable visual field loss less than 6 dB and not within 10 degrees of fixation. The patient may or may not have a normal IOP. There must be no change in disc, RNFL or visual field parameters over 3 years of follow-up. Stable patients may be on treatment.

Stable moderate glaucoma

These patients have definite optic disc pathology and/or repeatable visual field loss between 6 dB and 12 dB not within 10 degrees of fixation. The patient may or may not have a normal IOP. There must be no change in disc, retinal nerve fibre or visual field parameters over at least 3 years of follow-up.

Advanced glaucoma

These patients have definite optic disc pathology or repeatable visual field loss over 12 dB and/or within 10 degrees of fixation. The patient may or may not have a normal IOP. These patients are generally not suitable for collaborative care owing to the high risk of loss of functional vision.

Unstable glaucoma

These patients generally manifest one or more of the following:

- Newly diagnosed glaucoma patients in whom velocity of progression has not been established
- IOP above their medically determined IOP target/ IOP fluctuating more than 3 mmHg (i.e. changes above regression to the mean)
- Structural changes within the last 3 years
- Possible or likely glaucomatous field progression on HFA Guided Progression Analysis (GPA) within the last 3 years
- Optic disc haemorrhage
- Eye drop intolerance
- Other new ocular pathology
- Any glaucoma patient in whom stability has not been determined

These patients require a change in management to remedy an unsatisfactory situation. This may include laser or drainage surgery. These patients need to be referred to the treating ophthalmologist as soon as is practicable.

Acutely raised IOP

Acutely high IOP typically is accompanied by symptoms such as blurred vision, nausea and pain with an IOP often above 35 mmHg. Signs may include erythema, a shallow anterior chamber, a fixed pupil, white cells or blood in the anterior chamber and corneal oedema. This may or may not be accompanied by glaucomatous damage. Chronically raised IOP may provoke no signs or symptoms yet still may be markedly elevated.

Common causes include:

- Acute angle closure
- Uveitis
- Rubeosis/neovascularization
- PXF
- PDS

Typically, such scenarios are medical emergencies and may require surgical or laser as well as medical management. An ophthalmologist must be contacted as soon as possible to arrange urgent definitive treatment. While temporising treatment initiated by an optometrist independently might be necessary rarely for geographic or time reasons, in no way should it substitute for clear communication and transfer of care to an ophthalmologist as soon as possible. In Australia, this should be practicable in all but the most remote of settings and phone advice should always be available.

7. Collaborative Care for Glaucoma: Recommendations

- The accuracy and reliability of data collection is paramount. No optometrist should engage in glaucoma screening or monitoring unless they are able to perform clinical examination at least to the required standard of the appropriate regulator AND perform accurate and reliable measurements with the equipment available in the practice.
- Patients at high risk of visual loss from glaucoma should not be part of a collaborative care scheme and should be managed by an ophthalmologist.
- These include patients with:
 - Complex ocular pathology/secondary glaucoma (except for PXF or PDS as included above)
 - History of eye trauma with established glaucoma
 - Monocular patients with glaucoma
 - Patients who have undergone multiple ocular surgeries
 - Patients with advanced glaucoma (stable or unstable)
 - unstable glaucoma
 - acutely raised or very high (>35 mmHg) IOP need
- Patient choice should be paramount; patients should participate in an informed decision-making process in the choice of their eye health-care provider. Patients must be made fully aware of their treatment and monitoring options and the skills of the professionals involved.
- The ophthalmologist needs to have guided the development of the management plan and to be consulted at regular intervals. This enables the patient access to the full range of treatment options as well as to set target pressures as per NHMRC guidelines.⁸
- Patients with narrow angles (by van Herick or on gonioscopy) need a referral to an ophthalmologist as soon as possible as they may need laser treatment or surgery sooner than other groups to avert the risk of blinding disease.
- Collaborative care arrangements should be formalized in writing between parties with clear criteria for monitoring intervals, treatment plans and timeframes for referral between parties. As the welfare and safety of the patient is paramount, they should give fully informed consent and understand the nature of the collaborative care offered. They need to be informed who are their care providers and what level of care and treatment options each can provide with full practice contact details should they have queries. It also should be made clear as to what level of responsibility each party assumes for their care. Ideally, this should be provided in a written information sheet given to the patient.



Table 2 summarizes recommendations for management of glaucoma suspects and patients based on the clear definitions of risk and status categories we have presented. These are based on accurate and reliable assessments.

To reinforce communications between ophthalmology and optometry and to enhance professional standards that underpin safe collaborative care, ophthalmologists should be involved actively to increase optometric skills and knowledge for detection and monitoring.

Patient group	Management recommendation	Recommended monitoring intervals
Low-risk glaucoma suspect – glaucoma excluded by ophthalmologist	Serial assessment by optometrist or ophthalmologist depending on patient choice and availability. Any change in parameters should initiate re-referral to ophthalmologist.	Under 80: seen with visual field testing and <input type="checkbox"/> optic nerve imaging 6–12 monthly. Over 80: see yearly Should see an ophthalmologist at least every 3–4 years
High-risk glaucoma suspect- glaucoma excluded by ophthalmologist	Serial assessment by ophthalmologist or optometrist depending on patient choice and availability. Any change in parameters should initiate immediate re-referral to ophthalmologist.	Under 80: seen with visual field testing and <input type="checkbox"/> optic nerve imaging at least 6 monthly. Over 80: see at least yearly Should see an ophthalmologist at least every 2 years
Very high-risk glaucoma suspect- glaucoma excluded by ophthalmologist	Serial assessment by ophthalmologist or optometrist depending on patient choice and availability. Any change in parameters should initiate immediate re-referral to ophthalmologist.	Under 80: seen with: visual field testing and optic nerve imaging at least 6 monthly. Over 80: see at least yearly Should see an ophthalmologist at least every year
Early stable glaucoma	Serial assessment by ophthalmologist or alternating by ophthalmologist and optometrist depending on patient choice and availability. Should be changed to unstable category if findings change.	Under 80: seen with: visual field testing and optic nerve imaging at least 6 monthly. Over 80: see at least yearly Should see an ophthalmologist at least every 2 years
Moderate stable glaucoma	Serial assessment by ophthalmologist. Additional data input by optometrist to	Under 80: seen with visual field testing and optic nerve imaging at least 6 monthly.



	enhance management by ophthalmologist.	Over 80: see at least yearly Should see an ophthalmologist at least every year
Advanced glaucoma	Should be managed by an ophthalmologist.	At the discretion of the Ophthalmologist: Generally, at least 3–4 times a year
Unstable glaucoma	Needs referral to ophthalmologist as soon as possible	To be managed by an ophthalmologist until deemed stable again
Acutely raised IOP	Medical emergency; Needs immediate referral to an ophthalmologist. Emergency medical treatment can be initiated by a qualified optometrist as transfer is arranged	Definitive management is to be by an ophthalmologist

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9. Record of amendments to this document

Page	Details of Amendment	Date amended
Entire document	Created	05/2019