Prevention of primary angle-closure glaucoma in Asia

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Focused research is needed to reduce the prevalence of glaucoma in Asia

It has been estimated that 3.9 million people worldwide will be blind owing to primary angle-closure glaucoma (PACG) by 2010, and that this figure will rise to 5.3 million by 2020.¹ The majority of those affected will be living in Asia. These figures have been calculated using data accumulated from a number of population-based glaucoma surveys conducted in various countries in Asia over the last decade.²⁻⁸ Credit for highlighting the magnitude of the problem goes to the researchers who conducted these studies in which emphasis has been placed on carrying out gonioscopic examinations on all subjects and in using the International Society of Geographic and Epidemiological Ophthalmology (ISGEO)-standardised diagnostic definitions of glaucoma and angle closure.⁹ In this month's issue of the *BJO*, Casson *et al*¹⁰ (see page 856) report the prevalence of pre-glaucomatous angle closure in Myanmar in their comprehensive population-based survey. This paper focuses on the number of subjects aged ≥ 40 years classified as at risk of primary angle-closure suspects (PACS) and in the early stages of established primary angle closure (PAC) but with no evidence of glaucomatous optic neuropathy (prevalence 5.7% and 1.5%, respectively). The subdivision of the angle closure into PACS, PAC and PACG is part of the ISGEO classification and follows what is currently believed to be the natural history and assumed progression of the disease. Estimates for the prevalence of PAC and PACS vary slightly between different populations in the region. This may be partly due to variations in the age groups studied and interobserver variability of gonioscopy. But a consistent finding across the different surveys is the higher risk of angle closure in women and increasing age. These risk factors are reflected in Quigley's projected PACG estimates for 2010 and 2020.¹

This wealth of epidemiological data provides sufficient evidence that PACG is or will be a public health problem in Asia. Research programmes now need to focus on what can be done to reduce the

rate of blindness due to PACG over the next 20 years.

Where PACG seems to have an advantage over primary open-angle glaucoma is that the pre-glaucomatous stages of the disease (PACS and PAC) can be identified using gonioscopy, and that laser iridotomy is a relatively non-invasive intervention that can prevent progression to glaucoma. At first glance, it might seem that there is a strong case for implementing early detection of suspects (PACS) and treatment with prophylactic iridotomy. But, although this is an attractive idea, the evidence to justify such a programme on a large scale is not yet available. Understanding of the natural history and causal mechanisms underlying the pathogenesis of the angle-closure process is still limited, and this lack of knowledge means that the effectiveness of prophylactic iridotomy cannot be assumed and needs to be proven. Establishing the benefits of iridotomy in Asian people and determining who should be treated are among the current priorities for angle-closure research.

Although laser iridotomy has been effective in lowering intraocular pressures (IOPs) and opening the angle in Mongolian people,¹¹ suggesting the predominance of a pupil-block mechanism, a gonioscopic comparison of the angle width in Chinese adults with angle closure before and after iridotomy showed residual appositional closure in 19.4% eyes.¹² Although there is awareness that mechanisms of angle closure probably differ between Caucasian and Asian populations, these findings and those from other studies suggest that even within Asia, mechanisms underlying angle closure may vary between different populations.¹³⁻¹⁴ Non-pupil-block mechanisms amount to more than simply plateau iris configuration, an over-used term in the description of post-iridotomy residual angle closure. Crowding of the angle owing to a thick or anteriorly inserted iris, and the direct effect of a relatively large or anteriorly positioned lens on the angle are additional mechanisms that can contribute to closure

of the angle. Casson *et al*¹⁰ discuss the role of non-pupil-block mechanisms in their paper, and Ritch¹⁵ describes some of these in his classification of angle-closure mechanisms. Eyes with angle closure also tend towards certain biometric characteristics, including a shallow axial anterior chamber and steep corneal curvature.¹⁶⁻¹⁸ Rather than one mechanism alone being responsible, it is more likely that a combination of these anatomical factors cause apposition between the peripheral iris and the trabecular meshwork. There may also be additional (as yet unknown) factors, which stimulate formation of peripheral anterior synechiae (PAS).

In terms of treating pre-glaucomatous angle closure, laser iridotomy is unlikely to be successful in alleviating angle closure in cases where other mechanisms apart from pupil block predominate. On the other hand, even if there is only a small element of pupil block (as is present in most phakic eyes), alleviating this with an iridotomy may be enough to relieve iridotrabecular contact and prevent acute symptomatic angle closure. Anterior segment-imaging devices such as ultrasound biomicroscopy and anterior segment optical coherence tomography will supplement a good gonioscopic technique in enabling us to gain a better understanding of the anatomical and dynamic relationships between the peripheral iris, angle wall, ciliary body and lens.¹⁹ They also provide objective and repeatable measurements of angle width that can be compared before and after iridotomy.²⁰ But, although the discussion here has concentrated on the effects of iridotomy on angle configuration, ultimately the desired end points of treatment are the lowering of raised IOP or maintenance of normal IOP, and prevention of glaucomatous optic neuropathy.

Even if iridotomy were proved to be effective in treating all cases of angle closure and preventing disease progression, there is the second issue: should all PACSs be treated with a prophylactic iridotomy? A follow-up of untreated PACS cases in India showed that at 5 years, 22% had either PAS or increased IOP.²¹ Similarly, 28% of a cohort of untreated PAC cases developed optic-disc evidence of glaucoma over 5 years.²² The much higher prevalence of PACS cases compared with PAC cases in the survey published in this journal and in the other surveys also supports the hypothesis that only a proportion of individuals at risk (PACS) will develop glaucoma in their lifetime. As yet, there is little to indicate which cases are more at risk than others. Performing iridotomy on all suspects will result in overtreatment, and although iridotomy is less invasive and safer than

surgical treatment, it is not without risks, including raised IOP, inflammation and possibly cataract formation. These risks are balanced by the benefits when treating patients with definite disease (PAC and PACG cases), but mean that advocating universal treatment of otherwise healthy suspects may not be justified.

So, although good population-based data allow us to obtain a measure of the magnitude of PACG and the resulting blindness in Asia, resources now need be channelled into research focused on obtaining information on the natural history of the disease, the underlying causal mechanisms and the effectiveness of laser iridotomy and other interventions in halting or delaying the disease process. Once we have a greater understanding of these factors, we will be nearer to implementing public health initiatives aimed at reducing blindness due to glaucoma in Asia.

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REFERENCES

- 1 Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. *Br J Ophthalmol* 2006;**90**:262–7.
- 2 Foster PJ, Baasanhu J, Alsbirk PH, et al. Glaucoma in Mongolia. A population-based survey in Hovsgol province, northern Mongolia. *Arch Ophthalmol* 1996;**114**:1235–41.
- 3 Foster PJ, Oen FT, Machin D, et al. The prevalence of glaucoma in Chinese residents of Singapore: a cross-sectional population survey of the Tanjong Pagar district. *Arch Ophthalmol* 2000;**118**:1105–11.
- 4 Dandona L, Dandona R, Mandal P, et al. Angle-closure glaucoma in an urban population in southern India: the Andhra Pradesh Eye Disease Study. *Ophthalmology* 2000;**107**:1710–16.
- 5 Bourne RR, Sukudom P, Foster PJ, et al. Prevalence of glaucoma in Thailand: a population based survey in Rom Klao district, Bangkok. *Br J Ophthalmol* 2003;**87**:1069–74.
- 6 Ramakrishnan R, Nirmalan PK, Krishnadas R, et al. Glaucoma in a rural population of southern India: the Aravind Comprehensive Eye Survey. *Ophthalmology* 2003;**110**:1484–90.
- 7 Rahman MM, Rahman N, Foster PJ, et al. The prevalence of glaucoma in Bangladesh: a population based survey in Dhaka division. *Br J Ophthalmol* 2004;**88**:1493–7.
- 8 Vijaya L, George R, Arvind H, et al. Prevalence of angle-closure disease in a rural southern Indian population. *Arch Ophthalmol* 2006;**124**:403–9.
- 9 Foster P, Burhmann R, Quigley HA, et al. The definition and classification of glaucoma in prevalence surveys. *Br J Ophthalmol* 2002;**86**:238–42.
- 10 Casson RJ, Newland HS, Nuecke J, et al. The prevalence of glaucoma in rural Myanmar. *Br J Ophthalmol* 2007;**91**:856–9.
- 11 Nolan WP, Foster PJ, Devereux JG, et al. YAG laser iridotomy treatment for primary angle-closure in East Asian eyes. *Br J Ophthalmol* 2000;**84**:1255–9.
- 12 He M, Friedman DS, Ge J, et al. Laser peripheral iridotomy in primary angle-closure suspects: biometric and gonioscopic outcomes. The Liwan Eye Study. *Ophthalmology* 2006;**114**:494–500.
- 13 Wang N, Wu H, Fan Z. Primary angle closure glaucoma in Chinese and Western populations. *Chin Med J (Engl)* 2002;**115**:1706–15.
- 14 He M, Foster PJ, Johnson GJ, et al. Angle-closure glaucoma in Asian and European people. Different diseases? *Eye* 2006;**20**:3–12.
- 15 Ritch R, Lowe RF, In: Ritch R, Shields MB, Krupin T, eds. *The glaucomas*. 2nd edn. St Louis, MO: Mosby, 1996:801.
- 16 Alsbirk PH. Anterior chamber depth and primary angle-closure glaucoma. I. An epidemiologic study in Greenland Eskimos. *Acta Ophthalmol* 1975;**53**:89–104.
- 17 Clemmesen V, Alsbirk PH. Primary angle-closure glaucoma in Greenland. *Acta Ophthalmol* 1971;**49**:47–58.
- 18 Lowe RF. Primary angle-closure glaucoma: a review of ocular biometry. *Aust J Ophthalmol* 1977;**5**:9–17.
- 19 Nolan WP, See JL, Chew PT. Detection of primary angle closure using anterior segment optical coherence tomography in Asian eyes. *Ophthalmology* 2007;**114**:33–9.
- 20 Gazzard GAM, Friedman D, Devereux JG, et al. A prospective ultrasound biomicroscopy evaluation of changes in anterior segment morphology after laser iridotomy in Asian eyes. *Ophthalmology* 2003;**110**:630–8.
- 21 Thomas R, George R, Parikh R, et al. Five year risk of progression of primary angle closure suspects to primary angle closure: a population based study. *Br J Ophthalmol* 2003;**87**:450–4.
- 22 Thomas R, Parikh R, Mulyil J, et al. Five-year risk of progression of primary angle closure to primary angle closure glaucoma: a population-based study. *Acta Ophthalmol Scand* 2003;**81**:480–5.

UNCORRECTED REFRACTIVE ERROR AND PRESBYOPIA

Uncorrected refractive error and presbyopia: accommodating the unmet need

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Uncorrected refractive error barely features when it comes to reports of global visual impairment.¹ The reason is simple—the World Health Organization (WHO) definition² classifies visual impairment and blindness according to visual acuity with “best possible correction”. Recent population-based surveys have reported visual acuity in its many guises as uncorrected, presenting with habitual correction and best corrected. This work has exposed the enormous burden of uncorrected refractive error among industrialised^{3–4} and developing nations.^{5–6}

The survey from Timor-Leste reported by Ramke *et al*⁷ (see page 860) in this

issue of the *BJO* represents an important addition to the literature. This population-based survey reports on uncorrected refractive error and presbyopia in adults (aged ≥40 years) of Timor-Leste. This country is poverty stricken and has recently emerged as an independent democracy from a period of great upheaval. What is it about this survey that is of particular interest?

First, this is one of the few population-based surveys of refractive error that have reported on spectacle coverage for distance vision. We defined this term when reporting on spectacle coverage in the Bangladesh National Low Vision and Blindness Survey⁸ as Met refractive error

need/(Met refractive error need+Unmet refractive error need)×100. The authors of the Timor-Leste study have used this definition and have explored the assumptions involved with it, for distance and near vision—a useful exercise for further studies that intend to assess coverage. Unsurprisingly, distance spectacle coverage was higher among the urban and literate and those in paid employment, compared with rural, illiterate and those adults involved in subsistence farming.

Second, this survey is unusual in that it looked at the burden of presbyopia. The scale of this problem remains largely unknown in non-European-derived populations, with remarkably few population-based studies having addressed this issue.^{9–11} There is a perception that presbyopia is of less importance in locations where reading is uncommon; however, the Timor-Leste study⁷ and others^{9–11} have demonstrated a considerable unmet presbyopic need in largely rural locations. A recent study by Patel *et al*¹² in rural Tanzania also demonstrated that uncorrected refractive error has a significant impact on vision-related quality of life. There is a pressing need for more studies of presbyopia at a population level, as near vision, particularly the ability to read, is of great importance in socio-economic development.