

The Emerging Challenge of Age-related Eye Diseases in Singapore

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Abstract

Introduction: Eye diseases directly or indirectly related to ageing, such as cataract, glaucoma, age-related macular degeneration (AMD) and diabetic retinopathy constitute a significant cause of ocular morbidity in the elderly population. There is an increasing prevalence of age-related eye diseases (AREDS), a pattern that has already been evident in other developed country such as the United States of America. As a country reputed for her rapid progression to the status of a developed country, Singapore is not likely to be an exception to this trend. **Methods:** A literature search was carried out pertaining to AREDS and its impact on the community and the imposed economic burdens. **Results:** AREDS form a substantial proportion of the current public health disease burden due to the high morbidity and rehabilitation costs associated with visual loss. Although the exact figures are unknown, it is predictable that the increased prevalence of AREDS will result in greater consumption of healthcare resources. Several risk factors have been implicated in the development of AREDS. **Conclusions:** Through the modification of risk factors, patients may be able to prevent or delay the onset of visual loss associated with AREDS. It is therefore the onus of every health professional to be aware of the impact of AREDS and to rise to this emerging challenge by encouraging patients to take a more active role in the management of their ocular health.

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Introduction

Singapore has one of the fastest ageing populations in the world today. The current elderly population, defined as persons 65 years or older, comprises 7% of Singapore's total population and is expected to multiply almost threefold to 19% by the year 2030.¹ Although the current figure stands at 7%, the elderly population consumes 20% of public sector primary care and hospital services.¹ To address the challenges brought on by an ageing population, a Committee on Ageing Issues (CAI) was set up in 2004 by the Singapore government. CAI's vision is to achieve "Successful Ageing for Singapore" by enabling the elderly to maintain health, independence and security through the involvement of society.²

Concomitantly, the rapidly ageing population is also likely to result in a considerable increase in the prevalence

of important sight-threatening ocular conditions commonly affecting the elderly such as cataract, glaucoma, age-related macular degeneration (AMD) and diabetic retinopathy. Hereinafter, this collective is loosely termed as age-related eye diseases (AREDS). Such patterns are already evident in other developed country such as the United States of America (USA).³ Furthermore, there seems to be a corresponding increase in the frequency of these diseases with increasing age.^{4,5}

Visual impairment, particularly that caused by AREDS, is known to be associated with decreased mobility and physical performance,⁶ as well as an increase in hip fractures,⁷ depression,⁸ morbidity and mortality.⁹ Moreover, it has been observed that many people fear blindness more than death. In fact, they would be willing to trade a significant proportion of their lifespan for optimal vision.

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It is therefore important for medical professionals to be prepared for the emerging challenge of AREDs in Singapore and to educate the community about the prevention, screening and treatment of these diseases.

Age-related Eye Diseases

Cataract

Cataract, defined as clouding of the normally clear crystalline lens, is currently the leading cause of blindness in the world.¹⁰ A community-based study in Singapore showed that cataract was found in nearly 80% of the elderly population.¹¹

The most well known risk factor for developing cataract is ageing. Other risk factors for cataract formation include ultraviolet B radiation, smoking and oxidative stress. Studies have shown that an increased exposure to ultraviolet B (UVB) radiation poses a greater risk of cataract formation.¹² Smoking has also been shown to be associated with an increased incidence of cataract. In fact, smokers are at 3 times the risk of developing cataract, particularly nuclear cataract, compared with non-smokers.¹³ Based on circumstantial evidence, it is hypothetically plausible to state that smoking cessation or avoidance as well as use of sunglasses to block UVB radiation may reduce the risk of cataractogenesis.

The protective effect of antioxidants in preventing the development of cataract has long been the subject of controversy. A large, multicentre, randomised, placebo-controlled clinical trial of high-dose supplementation with vitamins C and E, and beta-carotene for age-related cataract and visual loss found no apparent effect on the development or progression of cataract.¹⁴

The only effective treatment for cataract is surgical removal, in which the cloudy lens is removed and replaced with an artificial intraocular lens. In Singapore, the number of cataract surgeries performed has been steadily increasing. This is in part due to the ageing population as well as improved accessibility to cataract surgery.¹⁵ Traditionally, about 67% of the patients undergoing cataract surgery fall between the ages of 60 and 79 years. However, there is a trend towards an increase in the proportion of those over 80 years of age undergoing cataract surgery as more people live longer.¹⁶

Glaucoma

Glaucoma, also known as the “silent thief of sight”, is a group of ocular conditions that cause optic neuropathy. Visual field loss caused by glaucoma is associated with increased disability and a higher incidence of falls in the elderly population.¹⁷

A study conducted on Chinese residents in Singapore indicated that the most common glaucomas diagnosed

were primary open-angle glaucoma at 49% and primary angle-closure glaucoma (PACG) at 31%.¹⁸ Female gender, Chinese race and age 60 years or older have been identified as risk factors for the development of acute PACG.¹⁹

Blindness due to glaucoma is irreversible. To add to the woe, there is no preventive measure for glaucoma. However, visual loss can be prevented if treatment is started before optic nerve damage has occurred. Therefore, detecting glaucoma early is crucial to prevent sight loss. However, due to the silent presentation of most cases of glaucoma and the lack of a single effective diagnostic tool, population screening has proved difficult. The measurement of intraocular pressure (IOP) is not sufficient for detecting glaucoma as patients with low (or normal) tension glaucoma have an IOP within the so-called normal range. Although clinical diagnosis of glaucoma mainly relies on the appearance of the optic disc, screening based on the evaluation of the optic disc has also been unreliable due to significant inter-observer variability.²⁰ Such limitations have spurred investigators to explore a vast array of screening options in the hope of easing this dilemma.

There still appears to be no body of substantial evidence to offer routine screening programmes for glaucoma to the general population. Nonetheless, it is advisable that screening be offered to populations at risk for glaucoma, such as those with positive family history, older than 60 years, history of steroid use, and possibly vascular disorders (systemic hypertension, nocturnal hypotension and vasospasm) and diabetes.

Age-related Macular Degeneration

AMD is the leading cause of blindness in developed countries.²¹ However, the awareness of this condition is alarmingly low among the general population, especially in Asia. A survey on 14 countries carried out by AMD Alliance International found that awareness levels in the USA were highest at 30%, whereas the awareness level fell to less than 10% in Hong Kong, Spain, Italy and Japan.²² A recent survey found a similar situation in Singapore with an awareness level of 7.3%.²³

AMD affects a person’s central vision and is broadly classified into 2 categories: dry (non-neovascular, non-exudative) and wet (neovascular, exudative) AMD. Dry AMD is more common, less visually debilitating and progresses more slowly than wet AMD, and is therefore considered the less severe of the two. Wet AMD is characterised by the development of choroidal neovascularisation, which can result in severe loss of vision due to bleeding and scarring.

Although the use of high-dose antioxidants and zinc supplementation has been shown to slow the progression from intermediate to advanced AMD, there is currently no

curative treatment for dry AMD.²⁴ For wet AMD, laser photocoagulation and photodynamic therapy (PDT) are the first 2 treatment options proven in large randomised controlled trials to be effective, and are presently still being used. In laser photocoagulation, a thermal energy is used to destroy abnormal new blood vessels not affecting the centre of macula. In PDT, a photosensitive dye (verteporfin) is first injected intravenously and the area of neovascularisation is subsequently irradiated with a non-thermal laser. Although PDT is effective in decreasing the risk of visual loss, patients usually require repeat treatments, and visual loss usually cannot be restored.²⁵ The most recent treatment developed for wet AMD is a group of anti-vascular endothelial growth factor (VEGF) agents administered by intravitreal injections. The VEGF Inhibition Study in Ocular Neovascularisation (VISION) revealed that pegaptanib sodium was effective in treating wet AMD.²⁶ Outcomes of the Minimally Classic/Occlud Trial of the Anti-VEGF Antibody Ranibizumab in the Treatment of Neovascular Age-Related Macular Degeneration (MARINA)²⁷ and the Anti-VEGF Antibody for the Treatment of Predominantly Classic Choroidal Neovascularisation in Age-Related Macular Degeneration (ANCHOR)²⁸ trials have also showed promising results in the use of ranibizumab in slowing the progression of wet AMD, and have even restored visual loss in some patients.²⁹ However, anti-VEGF therapy is currently relatively expensive and requires intravitreal maintenance injections every 4 to 6 weeks.

As there is no curative treatment for AMD, risk factor identification and modification remains the most important aspect in reducing the risk of development and progression of AMD. Several risk factors have been well-established; namely advanced age, female gender, genetic predisposition, Caucasian race and cigarette smoking. Of all these, only smoking is amenable to modification.

Smoking has been shown to play a significant role in the progression of AMD. Smoking doubles the risk of AMD and there appears to be a dose response, with increasing odds associated with an increase number of pack-years (number of pack years = number of packs of cigarettes smoked per day times the number of years the person has smoked) smoked.³⁰

In view of this, patients should be made aware of the link between smoking and AMD. A study conducted in a United Kingdom District General Hospital indicated that patients' awareness of the relation between smoking and blindness was low at 9.8%, compared with 92.2%, 87.6% and 70.6% for lung cancer, heart disease and stroke respectively.³¹ This huge disparity opens a new avenue for healthcare professionals to educate patients about blindness as a smoking-related condition to encourage smoking

cessation.

In response to the low awareness of AMD in Singapore, the AMD Awareness Week has been held locally every year since 2005 in conjunction with AMD Alliance International, a non-profit global organisation that works to increase people's awareness of AMD.³² During the course of the week, public forums on AMD and eye screening programmes are conducted throughout various parts of Singapore. In 2007, a Macular Degeneration Society was also launched in Singapore to help raise the awareness of this blinding condition and to provide patient support.

Diabetic Retinopathy

Although diabetic retinopathy is not a direct result of ageing per se, it is the fourth commonest cause of visual loss in the elderly.³³ This is because the greatest risk factor for diabetic retinopathy is the duration of diabetes mellitus. In the light of this, diabetic retinopathy forms an important component of geriatric ophthalmology.

Diabetic retinopathy is an important complication of diabetes mellitus and occurs as a result of damage to retinal blood vessels. Diabetic retinopathy can progress from mild non-proliferative diabetic retinopathy to advanced proliferative diabetic retinopathy. Leakage from blood vessels causes macular oedema that may result in visual loss.

Diabetic retinopathy is the leading cause of preventable blindness in Singapore.³⁴ Prevalence rates of diabetes in Singapore have been approximately doubling since the mid-1970s, reaching a figure of 8.2% in 2004.^{35,36} Accordingly, more people are at risk of diabetic retinopathy.

The progression of diabetic retinopathy is multifactorial. As mentioned above, the greatest risk factor is the duration of disease.³⁷ The Diabetes Control and Complications Trial (DCCT) showed that strict glycaemic control ($HbA_{1c} \leq 7\%$) reduces the risk of diabetic retinopathy by 76%.³⁸ Tight blood pressure control ($<130/85$ mm Hg)³⁹ and low serum cholesterol (<200 mg/dL) are also associated with a reduced risk of developing diabetic retinopathy.⁴⁰

In Singapore, many diabetics in the primary healthcare setting are screened annually for diabetic retinopathy using fundus photography. This screening programme has proven to be an effective method in detecting early diabetic eye changes. However, the reader of these retinal photographs must have sufficient training.⁴¹ This early detection of diabetic eye disease aids in timely intervention using laser photocoagulation, which in turn reduces the risk of visual loss.⁴²

Impact of Age-related Eye Diseases

In Australia, it has been found that the direct costs

incurred in treating eye disorders are extremely high; more than the cost of treating coronary heart disease, stroke, arthritis or depression. Indirect costs of visual loss are also estimated to be twice that amount, in the form of lost productivity in the workplace and increased use of rehabilitation aids.³³ A comparable trend has also developed in the USA, with direct medical costs of AREDs amounting to nearly US\$10.8 billion annually and direct non-medical costs of another US\$11.1 billion.⁴³ One cost analysis study using retrospective data in Singapore for the treatment of acute PACG found that each annual cohort would need to pay US\$261,741.78 [95% confidence interval (CI), US\$225,310.90-298,265.10] or US\$287,560.26 (95% CI, US\$247,274.04-330,624.84), if inclusive of cataract surgery, over 5 years after the episode of acute PACG and concluded that acute PACG produces a substantial financial burden on society as well as on the individuals.⁴⁴ Although the exact prevalence and its consequent public health impact of other AREDs in Singapore are unknown, the increasing longevity of Singaporeans and the rising proportion of elderly in the population are likely to cause a heavy economic burden similar to other developed countries. An increase in the prevalence of AREDs will not only result in greater consumption of healthcare resources through treatment of the ocular conditions as well as rehabilitation for the visually impaired, but also greater loss of productivity in the workplace.

Such statistics are an indication that the growing prevalence of AREDs will cause a potentially huge economic burden on Singapore's ageing population, and highlight a necessity for the prevention, early detection and treatment of AREDs where appropriate. In addition, more studies on AREDs and their economic impact on the Singapore society are warranted to help shape public health policies and manage limited healthcare resources. Through the implementation of such measures, the morbidity and public health costs associated with AREDs can be substantially reduced.

Prevention of Age-related Eye Diseases

Public education of primary prevention of AREDs through the modification of risk factors is the first step toward maintaining optimal ocular health in the elderly. Such public awareness campaigns include talks and exhibitions in public forums, community screening as well as media advertisements. Healthcare professionals and the government need not shoulder this enormous task alone. Non-governmental organisations and volunteer groups such as the Rotary Club and the Macular Degeneration Society can also contribute significantly to these national efforts.

Previous campaigns such as the "Singapore's OK" campaign on environmental hygiene launched in 2003 and

the smoking control campaign in 2007 have been effective in raising public awareness and thus greater societal participation. Another success story is Australia's National Quit Campaign, which utilises graphic warning labels to inform the public about the harmful effects of smoking. Among these labels, one reads "Smoking Causes Blindness" and briefly describes the relationship between smoking and AMD.

Presently, the Ministry of Health Singapore Clinical Practice Guidelines indicate that screening for impaired vision in the elderly should be done using a Snellen chart to test the visual acuity of each eye.⁴⁵ By detecting any changes in visual acuity, ocular conditions such as cataract can be identified. Visual acuity screening can be planned or done more opportunistically, such as when an elderly visits a healthcare facility for his non-ocular health needs. Such an opportunistic screening programme, called the LOVE (Loss Of Vision Evaluation) project, has been implemented in 2 healthcare facilities in Singapore. Besides using healthcare workers to perform the visual acuity measurements on elderly patients who visit the facility, patients can also measure their visual acuity on their own using Snellen charts incorporated in self-help kiosks distributed throughout the healthcare facilities.

Besides visual acuity testing, more comprehensive evidence-based eye-screening programmes for the elderly should be conducted. Currently, the only systematic eye-screening programme widely in place is for diabetics. Again, the 2 public healthcare facilities that offer the LOVE Project have taken the initiative to establish such a comprehensive eye-screening programme in Singapore, known as the Sight and Eye Evaluation (SEE) Project. Under the SEE Project, people aged 55 years and older undergo a detailed eye examination to detect the presence of AREDs and other ocular conditions. If any pathology is detected, patients are then counselled and referred for treatment if necessary. The benefit of early detection and treatment may be illustrated by the impact of secondary prevention of AMD in the USA where an estimated 8 million people above 55 years have monocular or binocular intermediate AMD and monocular advanced AMD. If no treatment is provided, 1.3 million would go on to develop advanced AMD, but with high-dose supplements of antioxidants and zinc, more than 300,000 (95% CI, 158,000 - 487,000) would avoid advanced AMD and any vision loss during the next 5 years.⁴⁶

Conclusion

The ageing population of Singapore is likely to increase considerably in the years to come, which may be reflected in an increased prevalence of AREDs, a pattern which has already been observed in some developed countries.

Although the exact figures are unknown, it is predicted that this increased prevalence of AREDs will result in greater consumption of healthcare resources.

Several risk factors implicated in the development of AREDs are amenable to modification by educating patients and implementing measures to prevent or delay the onset of visual loss associated with AREDs. This constitutes the additional responsibility that health professionals need to play. Having already been endowed with the medical expertise, they are in the most suitable position to empower their patients toward achieving this end.

The high economic burden inflicted on society and its individuals by AREDs cannot be overemphasised. Such a sizeable contribution in the form of high morbidity and rehabilitation costs should serve as a call for a concerted effort by all health professionals to exercise greater effort in promulgating this message.

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