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ORIGINAL ARTICLE

Profile of Visual Impairment in Older Adult Patients Attending Primary Eye Care Optometry Clinic: A Retrospective Study

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ABSTRAK

Peningkatan populasi penuaan, juga akan meningkatkan kekerapan gangguan penglihatan (VI). Kajian retrospektif dilakukan melibatkan fail pesakit warga emas yang berumur 60 tahun ke atas dari Klinik Optometri Rawatan Mata Primer (PEC) Universiti Kebangsaan Malaysia (UKM). Tujuan kajian ini adalah untuk menentukan kekerapan dan penyebab VI dalam kalangan warga emas. Kajian retrospektif ini dilakukan dengan merujuk fail pesakit warga emas yang berumur 60 tahun ke atas yang pertama kali mengunjungi PEC UKM dari tahun 2009 hingga 2019. Sosio-demografi, status kesihatan, status akuiti visual (VA), ralat refraksi, kekerapan dan penyebab VI sebelum dan selepas pembetulan ralat refraksi dianalisis dengan menggunakan statistik deskriptif. Pengukuran habitual VA diukur secara monokular dengan menggunakan carta Snellen dan direkod dalam unit perpuluhan. Purata habitual VA (sebelum pembetulan ralat refraksi) pada mata yang terbaik adalah 0.72±0.31, dengan julat antara 0.41 hingga 1.03, manakala purata VA selepas pembetulan ralat refraksi pada mata terbaik adalah 0.88±0.28 dengan julat antara 0.60 hingga 1.16. Kekerapan VI berdasarkan habitual VA adalah 16.0%. Penyebab utama VI berdasarkan habitual VA adalah katarak (53.4%). Status ralat refraksi selepas pembetulan menunjukkan peratusan hiperopia adalah paling tinggi (41.9%), diikuti oleh emmetropia (32.4%) dan miopia (25.7%). Penemuan kajian ini menekankan kepentingan meningkatkan tahap pengetahuan pesakit dan perkhidmatan optometri untuk mengurangkan masalah kebutaan yang boleh dielakkan.

Kata kunci: gangguan penglihatan, optometri, penjagaan mata primer, warga emas

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ABSTRACT

With an aging population, prevalence of visual impairment (VI) is expected to increase as well. A retrospective study was conducted involving the files of older adult patients aged 60 years and above from the Primary Eye Care (PEC) Optometry Clinic Universiti Kebangsaan Malaysia (UKM). This study was aimed to determine the prevalence and causes of VI among older adults. This retrospective study was conducted by reviewing files of older adult patients aged 60 years and above who had visited PEC Optometry Clinic UKM from 2009 to 2019. Socio-demographic, health status, status of visual acuity (VA), refractive error, prevalence and causes of VI before and after refractive correction were analysed by using descriptive statistic. Habitual distance VA was measured monocularly using the Snellen chart and recorded in decimal unit. The mean habitual distance VA in the better eye was 0.72±0.31, ranging from 0.41 to 1.03 while the mean VA after subjective refraction in the better eye was 0.88±0.28 which ranging from 0.60 to 1.16. The prevalence of VI based on habitual VA were 16.0%. The main cause of VI based on habitual VA was cataract (53.4%). The refractive status after subjective refraction showed highest percentage of hyperopia (41.9%), followed by emmetropia (32.4%) and myopia (25.7%). The findings of this study emphasise the importance of increased patient education and further expansion of optometric services are required to reduce avoidable blindness.

Keywords: elderly, optometry, primary eye care, visual impairment

INTRODUCTION

Primary eye care (PEC) services provide opportunity for the optometrists to manage more ocular problems within primary care, relieving pressure on the hospital eye services (HES) (Royal College of Ophthalmologists and College of Optometrists 2019). In PEC, early diagnosis could be possible via observation and assessment for either symptomatic or asymptomatic cases, with the needs of any prevention by treatment or rehabilitation can be given to relieve symptom or solve the problem (American Academy of Ophthalmology 2014).

In Malaysia, older adults are defined as individuals aged 60 and older (Jabatan Kebajikan Masyarakat 2017). Declining fertility rates, increasing life expectancy due to better medical health care, healthier diet and higher quality of life have led to the aging of the world's and Malaysia's population (Wan Ibrahim et al. 2017). In addition, the Department of Social Welfare (JKM) expects Malaysia to become an aging nation by 2030 (Jabatan Kebajikan Masyarakat 2017). An increase in the elderly population is often associated with age-related health problems (De Carvalho et al. 2004; Omar et al. 2011). Previous studies reported that visual

impairment (VI) is one of the health problems among older adults (Umfress & Brantley 2016; Wong et al. 2008).

Reddy et al. (2004) reported the prevalence of VI in Sepang varied among older adults and found significant increment in VI with age starting at age 40. A study in Sabah by Zin et al. (2015) reported more than half of 24 older adults aged 60 and over had VI. Moreover, a study in Selangor found higher risk of VI among older adults aged over 80 years (Abd Rahman et al. 2020). Even in China, it was reported that 10% of the older adults aged 50 years and above suffered from VI (Pan et al. 2016). This indicates that aging is one of the risk factor of VI, an age-related disease that occurs among older adults (Thakur et al. 2011).

Eye diseases associated with aging include macular degeneration (ARMD), glaucoma, refractive error and cataract (Reddy & Thevi 2017). In the National Eye Survey II (NES II), cataract was found to be the leading cause of VI and blindness among older adults in Malaysia (Chew et al. 2018). A study by Mohammed et al. (2016) showed that percentage of older adults having mild VI was higher compared to normal vision with most of them having refractive error.

NES II reported a more specific type of VI which consisted of moderate VI, severe VI and blindness (Chew et al. 2018). Blindness was defined as the presenting visual acuity of worse than 3/60 in the better eye. Severe VI was defined as presenting visual acuity worse than 6/60 but better than or equal to 3/60 in the better eye. Moderate VI was defined as presenting visual acuity worse than 6/18 but better than or equal to 6/60 in the better eye. In that report, untreated cataract had the highest percentage among causes of moderate VI (68.2%), severe VI (70.1%) and blindness (58.6%) among older adults (Chew et al. 2018). The same report also showed that the second major causes of VI differed with type of VI, which were uncorrected refractive error (15.9%) for moderate VI, and diabetic retinopathy (DR) for severe VI (8.4%). However, other study stated that uncorrected refractive error (43%) was the leading cause of VI, followed by cataract (33%) (Pascolini & Mariotti 2012).

The growth of the older adult's population has become a significant demographic trend in the past decades of the world's and Malaysia's population. However, there was a lack of information on the prevalence and causes of VI among older adults in clinic-based or hospital-based studies. Generally, this study provides information on the profile of visual status of older adults attending the PEC Optometry Clinic, Universiti Kebangsaan Malaysia (UKM). A better planning for managing older adult patients with VI can be proposed based on the data obtained. In addition, this information can also assist optometrists and ophthalmologists in future planning for optimal screening, treatment and rehabilitation, especially for older adults, specifically in Malaysia.

MATERIALS AND METHODS

Study Design

This was a retrospective study done by reviewing the files of older adults aged 60 years and above who had first visit to PEC Optometry Clinic UKM in the period of year 2009 until 2019. The study adhered to the Declaration of Helsinki and was approved by the Medical Research and Ethics Committee of Universiti Kebangsaan Malaysia (UKM.FSK.800-2/27/9/NN-2020-048). The inclusion criteria were older adults aged 60 and with the first visit to PEC Optometry Clinic between 2009 to 2019. Any patient's files with incomplete data were excluded.

The sample size was determined based on Krejcie & Morgan (1970) formula:

$$s = [X^2NP(1-P)]/[\Delta^2(N-1) + X^2P(1-P)]$$

where s is the sample size, X is the chi-square value for 1 degree of freedom at 95% confidence level ($\alpha = 0.05$), N is the population size in 2019 (3.4 million older adults 60 and older in Malaysia) (Department of Statistics Malaysia 2018), P is the maximum variability ratio for the population (0.5) and (Delta) is the effect of the size or margin error on the population with a value of 5% ≈ 0.05. Calculated sample size was added with 10% drop out. Therefore, the sample size required for this study was 423. In this study, a total of 464 patient's files fulfilling the inclusion criteria were selected from the PEC Clinic UKM.

Socio-demographic and Ophthalmic Findings

Socio-demographic information including age, race, gender and educational level as well as health status were extracted. Ophthalmic findings including status of visual acuity (VA), refractive error and diagnosis, which was available from routine clinical practice were obtained. Data on registration with JKM were also identified from patient's files. Habitual distance VA was measured monocularly using the Snellen chart and recorded in a decimal unit. Refractive error was determined using a retinoscopy technique followed by subjective refraction. All the examinations were conducted by an optometrist.

International Classification of Diseases 11th revision (ICD-11) was used for the classification of VI (WHO 2018). Based on ICD-11, habitual VA was used to categorise subjects into mild VI (6/12<VA≤6/18), moderate VI (6/18<VA≤6/60), severe VI (6/60<VA≤3/60) and blindness (VA<3/60) (WHO 2018). VA 6/12 was classified as no VI or normal vision. Refractive error was converted to spherical equivalent (SE) with spherical components added to half-cylindrical component. SE was classified into emmetropia (-0.50D≤SE≤+0.50D), myopia (SE<-0.50D) and hyperopia (SE>+0.50D) (Althomali 2018; Flitcroft et al. 2019). For analysis purposes, VA was converted to decimal VA.

Statistical Analysis

The statistical analyses were performed using IBM SPSS statistics 25 (IBM Corp. Armonk, NY). Descriptive statistics were used to describe socio-demographic, health status, status of

VA, refractive error, prevalence and causes of VI. McNemar's test analysis was used to compare the prevalence of VI between habitual VA and after refractive error correction.

RESULTS

A total number of 464 files were read but only 456 files were analysed as seven were excluded due to incomplete data in patients' files. The socio-demographic and the health conditions of the subjects are summarised in Table 1.

Habitual distance VA for the better eye ranged from 0.41 to 1.03 with mean of 0.72±0.31. Based on the history taking, 313 subjects (68.6%) wore a spectacle either for distance or near or both vision and 143 subjects (31.4%) did not wear any corrections. The mean refractive error of better eye was +0.13±1.93D which ranged from -7.75D to +5.75D. The mean VA of the better eye after correction was 0.88±0.28 with a range of 0.60 to 1.16. Overall percentage of refractive error for distance showed the highest percentage of hyperopia (41.9%), followed by emmetropia (32.4%) and myopia (25.7%).

McNemar's test showed the decrease of the prevalence of VI after refractive error correction was significant compared to habitual VA

Table 1: Socio-demographic, and health conditions of the subjects

Characteristics	Value (n=456)
Mean age	67.40±6.0 (Range: 61-73)
Ethnicity	
Malay	292 (64.0%)
Chinese	111 (24.3%)
Indian	35 (7.8%)
Others	18 (3.9%)
Gender	
Male	219 (48.0%)
Female	237 (52.0%)
Health condition	
Hypertension	
Yes	204 (44.7%)
No	252 (55.3%)
Diabetes	
Yes	139 (30.5%)
No	317 (69.5%)
Cholesterol	
Yes	116 (25.4%)
No	340 (74.6%)
Heart Disease	
Yes	39 (8.6%)
No	417 (91.4%)
Others	
Yes	82 (18.0%)
No	374 (82.0%)

Table 2: The classification of VI before and after refractive error correction

Type of Visual Impairment	VI before refractive error correction (n=456)	VI after refractive error correction (n=456)
Normal	383 (84.0%)	425 (93.2%)
Mild	34 (7.5%)	15 (3.3%)
Moderate	30 (6.6%)	8 (1.8%)
Severe	3 (0.6%)	3 (0.6%)
Blind	6 (1.3%)	5 (1.1%)

($p<0.001$). Based on the habitual VA, the prevalence of VI was 16.0%, in which 34 subjects (7.5%) had mild VI, 30 subjects (6.6%) had moderate VI, three subjects (0.6%) had severe VI and six subjects (1.3%) were considered blind. However, the prevalence of VI reduced to 6.8% after refractive error correction. Table 2 summarises the classification of VI based on habitual VA and after refractive error correction.

Based on habitual VA, the main cause of VI was cataract with 39 subjects (53.4%). After the correction of refractive error, cataract remained as the main cause of VI but decreased to 26 subjects (83.9%). Table 3 summarises the causes of VI for habitual VA.

DISCUSSION

This study revealed that 84.0% (n=383) of subjects had no VI based on habitual VA and 16.0% (n=73) of the subjects had VI, indicating that a large proportion of older adults preserve a good level of VA with age. This study shows that in those with VI, 57.5% (n=42) could be remediated by a simple update in the ocular refraction. However, VI remained in 6.8% (n=31) of the subjects due to cataract. This finding showed that some of the causes of VI could be corrected with glasses, contact lenses, or refractive surgery (Han et al. 2019).

The prevalence of VI among older adults reported in past literature varied considerably. Chew et al. (2018) reported a lower prevalence (7.6%), while Reddy et al. (2004) reported a higher prevalence (21.8%) of VI among older adults among the Malaysian population when compared to this study. Other studies reported a higher prevalance of VI among older adults aged 60 and above, 52.3% (Noran et al. 2009) and 37.0% (Chriqui et al. 2017).

The discrepancy presented in prevalence between studies might be attributed to the difference in the criterion for VI, assessment method, sample age groups and, type of population (population-based study vs hospital-based study), thus making it difficult to make a fair comparison. A previous study also showed that

Table 3: The causes of vision impairment

Causes of VI	Habitual VA (n=73)
Cataract	39 (53.4%)
Uncorrected Refractive Error	28 (38.4%)
Diabetic Retinopathy	4 (5.4%)
Glaucoma	1 (1.4%)
Retinal Detachment	1 (1.4%)

the prevalence of VI in hospital-based studies were higher than population-based (Reddy et al. 2008).

In this study, the leading causes of VI based on habitual VA was cataract (53.4%), similarly reported by a study from University of Malaya Medical Centre (Reddy et al. 2008). As we age, the components of the crystalline lens respond asymmetrically. The effects of age-related changes on the crystalline lens include increase in light-scatter, decreased elasticity and changes in the lens proteins, which causes loss of transparency of the lens, loss of antioxidant and free-radical scavenging capacity (Michael & Bron 2011). These effects will lead to the formation of age-related cataract.

Reddy et al. (2008) reported that cataract (32.9%) was the most common eye disease seen in the elderly and was associated with diabetes, hypertension and ischemic heart disease. The subjects in this study were found to have several health conditions such as diabetes (30.5%), hypertension (44.7%), heart disease (8.6%), cholesterol (25.4%) and other conditions. Wang et al. (2003) reported that apart from ageing, health condition was also one of the factors that might contribute to the VI. Systemic diseases, including diabetes mellitus (DM), hypertension, lipid content and cholesterol, were also reported as one of the risk factors for cataract (Gupta et al. 2014). Previous study revealed a causal biochemical relationship between DM and cataract development (Pollreisz & Schmidt-Erfurth 2010; Bhadania 2016); DM appears to be one of the main risk factors for developing cataract (Pék et al. 2020). The highest cholesterol content was found on the lens membrane than any known membrane (Cenedella 1996). This study stated that alteration of the composition and content of lens sterols could be associated with cataract formation.

Cataract was the leading causes of avoidable and reversible VI (Chew et al. 2018). If the cataract was detected earlier, preventive step such as cataract surgery could be carried out, and a probability to have a better VA would be higher (VanNewkirk et al. 2001). However, there were limitations in facilities, equipment and human resources for ophthalmology services in Malaysia, which is primarily operated by government specialist hospitals (Foo et al. 2015). The Cataract Surgery Barrier Model highlighted a few issues that served as barriers in assessing cataract surgery services in Malaysia. This included their perceived need for sight, apprehension, physical status, family support, financial adversity, nondisclosure of their visual problems, belated needs for better sight, social stigma, miscommunication and delayed referral (Mutalib et al. 2019; Nurulain et al. 2018). The studies also found that factors at the specialist level, which were accessibility, bureaucracy, waiting time and cost also contributed to the barrier in assessing cataract surgery services in Malaysia.

The national cataract surgical rate was also notably low as compared to the WHO target; factors causing this were poor access to the eye care services on both facilities and equipment, inadequate human

resources such as ophthalmologists and poor individual attitudes to the uptake of service (Morny et al. 2019). Although private hospitals offered such services, the higher cost increased the demand at government hospitals. A four to six-month waiting period for elective cataract surgery is common (Foo et al. 2015). The study by Evans et al. (2004) also reported quite a number of waitlists for cataract surgery as well as patients who were in the process of being referred due to cataract.

Apart from cataract, uncorrected refractive error was found to be the second leading cause of VI in our study. However, there was 9.2% reduction in the prevalence of VI among the elderly in PEC Optometry UKM after correction of VA from our study. Thapa et al. (2018) also reported a significant reduction of VI prevalence from 52.9% to 22.9% after best correction was given. This shows that the prevalence of VI can be reduced by correcting the refractive error. It was suggested that routine vision screening, regular follow up after a cataract surgery and provision of spectacles could reduce these avoidable VI (Thapa et al. 2018). Previous study suggested continuing public education of the importance of correcting the refractive error will significantly lower the prevalence of VI (Morny et al. 2019).

The study found that the highest prevalence of refractive error among older adults was hyperopia, whereas myopia was the least among them. This finding supports a study by Yekta et al. (2009), which indicated that the prevalence of hyperopia (51.6%) was higher compared to myopia (27.2%) among older adults. Previous report by Kuang et al. (2017) also found higher prevalence of hyperopia among older adults even after a seven-years follow up. The primary cause of the age-related hyperopia was suggested to be the change in the gradient of the lens refractive index (Atchison et al. 2008; Haegerstrom-Portnoy et al. 2014). The growth of new fibers on the lens surface causes the deeper layer to be compacted with older fibers, reducing the crystalline lens refractive power, thus causing hyperopic shift among the elderly (Augusteyn 2008; Hashemi et al. 2010; Iribarren et al. 2015). Another main ocular component correlated with the refractive error was the axial length. A study by Iribarren et al. (2015) stated that a longer axial length had a lower lens power, indicating hyperopia among the elderly. However, another study found that the myopic shift among the elderly was caused by nuclear cataract (Iribarren et al. 2012). This phenomenon can be explained by a hardening and thinning of the crystalline lens with loss of bound water, leading to an increase of refractive index resulting in myopic shift over time (Heys et al. 2008).

Other causes of VI in our study were DR, glaucoma and retinal detachment. The WHO (2019) reported that other eye diseases related to aging that can contribute to VI were cataract, macular degeneration, glaucoma, and DR. Another study reported that uncorrected refractive error, followed by cataract, ARMD, glaucoma and DR (Flaxman et al. 2017). Since subjects in our study were considered to be a clinic-based population, it is

conceivable that reports on advanced cases such as ARMD, glaucoma and DR were lesser.

Overall, the prevalence of VI was reduced to 6.8% after correction of the refractive errors. Thus, it is suggested that vision screening at the age of 60 years and above on cataract, posterior segment diseases, correct refractive power and timely referral will help in reducing VI cases, with a yearly check-up starting at as early as 40 years old should be considered (Thapa et al. 2018). Apart from ocular diseases, VI could also be associated with daily lifestyles such as smoking, drinking, bad eating behavior and fewer fruit intakes (Tetteh et al. 2020). Thus, controlling these factors will slow down the progression of the diseases.

CONCLUSION

To conclude, this clinic-based study reported a higher prevalence of VI as compared to previous study in Malaysia. The main causes of VI were cataract and uncorrected refractive error which can be treated by surgical intervention or ophthalmic correction. Therefore, PEC plays a crucial role in managing eye care problems before referring to secondary and tertiary eye care services. Collaboration between PEC and specialist expertise would potentially preventing VI, reducing its prevalence.

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