

Risk Factors for Cataract: A Case Study at National University of Malaysia Hospital

SHARANJEET-KAUR, ARIFAH NUR YAHYA, CHE MUHAYA MOHAMAD & MCCARTY, C.A.

ABSTRAK

Tujuan kajian ini adalah untuk mengenal pasti jenis katarak kaitan-umur yang paling umum dan mengkaji faktor risiko bagi katarak jenis kaitan-umur di dalam sampel pesakit katarak di Hospital Universiti Kebangsaan Malaysia. Seramai 35 pesakit (17 orang lelaki dan 18 orang perempuan) dengan katarak dari wad dan klinik oftalmologi di hospital tersebut telah direkrut. Julat umur pesakit adalah antara 39 hingga 93 tahun (min 64.9 ± 11.5 tahun). Sistem 'The Lens Opacities Classification System (LOCS) III' telah digunakan untuk mengkedkan opasiti nuklear, kortikal, dan subkapsular posterior. Pengredan katarak telah dijalankan dan maklumat berikut telah dikumpulkan: akuiti visual permulaan dan akuiti visual dengan pembedulan terbaik, keterangan demografi, sejarah kesihatan, pengambilan diet antioksidan serta pendedahan mata kepada ultraunggu B sepanjang hayat. Analisis telah dilakukan menggunakan 'standard case-control design'. Ujian-t telah digunakan untuk menilai kesignifikanan pemboleh ubah berterusan dan ujian 'chi-squared' digunakan untuk pembolehubah kategorikal. Prevalens keseluruhan katarak jenis kortikal adalah 34.4% (12 pesakit), katarak nuklear 60.0% (21 pesakit) dan katarak subkapsular posterior 57.1% (20 pesakit). Tiada sebarang faktor risiko dijumpai bagi katarak jenis nuklear. Bagi katarak subkapsular posterior, hipertensi sahaja merupakan faktor risiko berpotensi ($\chi^2 = 4.38, p = 0.036$), dan bagi katarak kortikal, hanya menghisap rokok didapati sebagai faktor risiko yang signifikan. Pendedahan efektif okular UV-B didapati bukan satu faktor risiko berpotensi yang signifikan. Namun dapat dilihat perbezaan min pendedahan efektif okular UV-B antara pesakit dengan katarak kortikal dengan mereka yang tiada katarak kortikal adalah lebih besar berbanding katarak jenis nuklear dan subkapsular posterior. Hipertensi pula didapati sebagai faktor risiko berpotensi bagi katarak jenis subkapsular posterior manakala menghisap rokok merupakan faktor risiko berpotensi bagi katarak jenis kortikal. Walaupun tidak signifikan secara statistik, pendedahan efektif okular UV-B mungkin merupakan satu faktor risiko berpotensi bagi kejadian katarak jenis kortikal.

Kata kunci: Faktor risiko, katarak jenis kaitan-umur, pendedahan UV-B, penyakit sistemik, menghisap rokok.

ABSTRACT

The purpose of this study was to identify the most common forms of age-related cataracts and to estimate possible risk factors for age-related cataracts in a sample of cataract patients at the National University of Malaysia Hospital. Thirty five patients (17 males and 18 female) with cataracts were recruited from the ophthalmology ward and clinic at the hospital. The age range of the patients was between 39 to 93 years (mean 64.9 ± 11.5 years). The Lens Opacities Classification System (LOCS) III was used to grade nuclear, cortical and posterior subcapsular lens opacities. Grading of the cataract was carried out and the following information was collected: initial visual acuity and best-corrected visual acuity, demographic details, health history, dietary intake of antioxidants and lifetime ocular ultraviolet B exposure. Analyses were conducted using a standard case-control design. T-tests were used to assess the significance of continuous variables and chi-squared tests were used for categorical variables. The overall prevalence of cortical cataract was 34.4% (12 patients), nuclear cataract was 60.0% (21 patients), and posterior subcapsular cataract was 57.1% (20 patients). No significant potential risk factor was found for nuclear cataracts. In the case of posterior subcapsular cataract, hypertension was the only potential significant risk factor ($\chi^2 = 4.38$, $p = 0.036$), and in the case of cortical cataract, cigarette smoking was the only significant risk factor. Although lifetime effective ocular UV-B exposure was found to be not a significant potential risk factor, but it was seen that for cortical cataracts, the mean difference of lifetime effective ocular UV-B exposure between those with cortical and those without cortical cataracts was larger compared to others with nuclear and posterior subcapsular cataracts. Hypertension was found to be a potential significant risk factor for posterior subcapsular cataract whereas cigarette smoking was a potentially significant risk factor for cortical cataract. Although not statistically significant, lifetime effective ocular UV-B exposure maybe a potential risk factor for cortical cataract.

Key words: Risk factors, age-related cataract, UV-B exposure, systemic disease, cigarette smoking.

INTRODUCTION

Worldwide, cataract is the leading cause of blindness (Thylefors et al. 1994). A similar trend is seen in Malaysia. Results from the National Eye Survey 1996 showed that 39% of blindness and 36% of low vision were due to cataracts

(Zainal et al. 2002a; 2002b). The prevalence of cataract in Malaysia was 2.58% and women had a higher prevalence (2.69%) compared to men (2.46%). There was an exponential increase of cataracts after 40 years of age. The age group with the highest prevalence of cataracts was the 70 years and above group with a prevalence of 54.55%. Indians had the highest prevalence of cataracts (3.63%) followed by the other indigenous group (2.79%), Chinese (2.69%) and Malays (2.29%) with the lowest prevalence. Urban areas had a lower prevalence of cataracts (2.48%) compared to rural areas (2.66%). The state of Melaka had the highest prevalence of cataracts (5.31%) followed by the Federal Territory of Kuala Lumpur (3.37%) and the state of Sabah (3.32%) (Zainal et al. 2002a; 2002b).

The National Eye Survey 1996 (Zainal et al. 2002a, 2002b) showed that the prevalence of treated cataracts in Malaysia was 0.39% with women having a lower prevalence (0.37%) compared to men (0.38%). The prevalence of aphakic treated cataracts in Malaysia was 0.16%. The prevalence of pseudophakic treated cataracts in Malaysia was 0.23%. There was an exponential increase of treated cataracts after 40 years of age. The age group with the highest prevalence of treated cataracts was the 70 years and above group with a prevalence of 9.02%. Malays had the lowest prevalence of treated cataracts (0.17%) followed by the "other indigenous" group (0.19%), Chinese (0.59%) and Indians (1.05%) with the highest prevalence. Urban areas had a higher prevalence of treated cataracts (0.48%) compared to rural areas (0.29%). The state of Kelantan had the lowest prevalence of treated cataracts (0.08%) followed by Perlis (0.13%) and the state of Negeri Sembilan (0.15%).

According to the National Eye Survey 1996 (Zainal et al. 2002a; 2002b), the prevalence of untreated cataracts in Malaysia was 2.2% with women having a higher prevalence (2.32%) compared to men (2.08%). There was an exponential increase of untreated cataracts after 10 years of age. The age group with the highest prevalence of untreated cataracts was the 70 years and above group with a prevalence of 45.52%. The "other indigenous" group had the highest prevalence of untreated cataracts (2.61%) followed by Indians (2.58%), Malays (2.12%) and Chinese (2.10%) with the lowest prevalence. Urban areas had a lower prevalence of untreated cataracts (1.99%) compared to rural areas (2.36%). The state of Melaka had the highest prevalence of untreated cataracts (4.62%) followed by Sabah (2.99%) and the Federal Territory of Kuala Lumpur (2.98%).

Cataract surgery is a commonly performed surgery in hospitals. A recent survey showed that cataract surgery was usually performed on subjects between the ages of 65 to 74 years (Goh et al. 2003). It was also observed that patients who underwent cataract surgery had other systemic problems such as hypertension (33%), diabetes mellitus (28%), heart disease (9%) and COAD/asthma (6%). Although cataract surgery is relatively safe and effective as a means of secondary prevention of blindness, primary prevention is better as it has the potential of saving the health care system money and at the same time

improving the visual function and independence of the elderly in the population which seems to be growing in number. A recent report showed that the average cost of Extracapsular Cataract Extraction with intraocular lens implantation was between RM2174 to 4611. For phacoemulsification surgery with intraocular lens implantation, the cost ranged from RM2886 to 6069 (Arumugum et al. 2003).

Population-based reports of cataract prevalence have shown that cortical and nuclear cataracts were the most common forms of age-related cataract in the western population (Sperduto & Hiller 1984; Mariani et al. 1990; Klein et al. 1992; Guiffre et al. 1995; Mitchell et al. 1997). There are numerous investigations looking into the possible risk factors for cataracts in the population (Hiller et al. 1986; Leske et al. 1991; The Italian-American Cataract Study Group 1991; Miglior et al. 1994; The Framingham Offspring Eye Study Group 1994; Taylor et al. 1988; Cruickshanks et al. 1992; McCarty et al. 2000). Reviews have revealed both nonmodifiable, such as age and gender, and modifiable risk factors such as UV light exposure, smoking, certain medications and low antioxidant intake (West & Valmadrid 1995; Hodge et al. 1995).

The purpose of this study was to look at the most common forms of age-related cataracts and to estimate the risk factors for cortical, nuclear and posterior subcapsular cataract in a sample of patients at the National University of Malaysia Hospital (HUKM).

MATERIALS AND METHODS

Patients who attended the cataract unit of the ophthalmology clinic and scheduled for cataract surgery between September and October 2002 in the ophthalmology ward of the National University of Malaysia Hospital (HUKM) were recruited in this study. Informed consent was first obtained from every patient before any information was collected from them. Patients with cataracts were interviewed to gather information about demographics. A standardized questionnaire adapted from the Melbourne Visual Impairment Project (Livingstone et al. 1994) was used to obtain information about education, employment, occurrence, duration and treatment of medical conditions like ocular trauma, arthritis, diabetes, gout, hypertension, heart disease, asthma, lung disease, renal disease, mental disorders, glaucoma and age-related macular degeneration, dietary consumption of antioxidants and vitamin supplements. Medical history was also obtained from hospital records to counter check that medical information provided was accurate and complete. Lifetime ocular UV-B exposure was determined for each individual from information about place of residence, time spent outdoors, and use of ocular protection devices like hats, spectacles and sunglasses (McCarty et al. 1996). An ophthalmologist graded lens opacities clinically at the time of the examination using the Lens Opacities Classification System (LOCS) III. The analyses of the results were conducted

using a standard case-control design. The controls here have different types of cataract. The interpretation of the results was the odds of developing one type of cataract relative to other types of cataract. T-tests were used to assess the significance of continuous variables and chi-squared tests were used for categorical variables (Fisher's exact when expected cell counts were less than 5). Two-sided tests and $\alpha = 0.05$ were used for significance testing. The relatively small sample size did not allow for multivariate analyses. Also no significance testing was done for any variables where the frequency count was less than 5.

RESULTS

A total of 35 cataract patients were recruited, comprising 17 males (48.6%) and 18 females (51.4%). The age ranges of the patients were between 39 to 93 years (mean 64.9 ± 11.5 years). The demographic distribution of the patients is shown in Table 1. Most of the patients recruited with cataracts were in the 60 to 79 years age group. The overall prevalence of cortical cataract was 34.4% (12 patients), nuclear cataract was 60.0% (21 patients), and posterior subcapsular cataract was 57.1% (20 patients). The relative distribution of the different types of cataract at different age groups is shown in Figure 1. Most patients in the 60-69 years age group had nuclear cataract (15.9%), some had cortical cataracts (8.4%) and some had posterior subcapsular cataracts (8.4%). In the 70 to 79 years age group, most patients had nuclear cataracts (15%) and posterior subcapsular cataracts (15%), while others had cortical cataracts (8.4%) and mature cataracts (1.9%).

Tables 2, 3 and 4 shows the percent of people with cortical cataract, nuclear cataract and posterior subcapsular cataract by risk factor status and associated significance testing. No significant potential risk factors were found for nuclear cataract. In the case of cortical cataract, smoking cigarettes was found to be a significant risk factor ($p = 0.05$). In the case of posterior subcapsular cataract, hypertension was the only potential significant risk factor ($\chi^2 = 4.38$, $p = 0.036$). Lifetime effective ocular UV-B exposures were also calculated. Although lifetime effective ocular UV-B exposure was found to be not a significant potential risk factor, but it was seen that for cortical cataracts, the mean difference of lifetime effective ocular UV-B exposure between those with cortical cataracts (mean = 52 ± 24.2 years) and those without cortical cataracts (mean = 39.9 ± 20.0 years) was larger compared to others with and without nuclear (mean = 45.8 ± 21.3 versus mean = 41.5 ± 23.5 years) and posterior subcapsular cataracts (mean = 46.4 ± 18.9 versus mean = 41.0 ± 25.8 years) shown in Table 5.

TABLE 1. Characteristics of the study group

(a) Categorical variables of the subjects.

Characteristic	Number	Percent
Gender		
Male	17	48.6
Female	18	51.4
Race		
Malay	19	54.3
Chinese	11	31.4
Indian	3	8.6
Others	2	5.7
Age range		
35-49 years	5	14.3
50-59 years	5	14.3
60-69 years	11	31.4
70-79 years	12	34.3
80-89 years	1	2.9
>90 years	1	2.9
Cataract type		
Cortical	12	34.3
Nuclear	21	60.0
PSC	20	57.1
Use of distance correction	22	62.9
Presence of disease		
Diabetes	14	40.0
Gout	4	11.4
Hypertension	21	60.0
Heart disease	9	25.7
Asthma	6	17.1
Renal disease	4	11.4
Glaucoma	2	5.7
Use of medications		
Aspirin	5	41.3
Paracetamol	11	31.4
Topical steroids	1	2.9
Allopurinol	1	2.9
Insulin	3	8.6
Use of nutrient supplements	13	37.1
Cigarette smoker	14	40.0
Drink alcohol	5	14.3
Family history of cataract	12	34.3
History of ocular trauma	2	5.7

(b) Continuous variables of the subjects.

Characteristics	Mean	Standard deviation	Range
Age (years)	64.9	11.5	39 to 93
Lifetime effective ocular UV-B exposure	44.1	21.9	6.3 to 96.0
Near add	1.94	1.42	0 to 3.0

TABLE 2. Percent of people with cortical cataract by risk factor status, and associated significance testing

Potential risk factor	Number (%) who have cortical cataract	Chi-square	p-value
Gender			
Male	4/17 (23.5)		
Female	8/18 (44.4)	1.70	0.19
Race			
Malay	5/19 (26.3)		Fisher's exact
Chinese	6/11 (54.5)	N/A	P = 0.24
Use of distance correction			
Yes	8/22 (36.4)		Fisher's exact
No	4/13 (30.8)	N/A	P = 1.00
Diabetes			
Yes	3/14 (21.4)		Fisher's exact
No	9/21 (42.9)	N/A	P = 0.106
Hypertension			
Yes	5/21 (23.8)		Fisher's exact
No	7/14 (50.0)	N/A	P = 0.153
Heart disease			
Yes	3/9 (33.3)		Fisher's exact
No	9/26 (34.6)	N/A	P = 1.00
Asthma			
Yes	3/6 (50.0)		Fisher's exact
No	9/29 (31.0)	N/A	P = 0.39
Aspirin use			
Yes	2/5 (40.0)		Fisher's exact
No	10/30 (33.3)	N/A	P = 1.00
Paracetamol use			
Yes	4/11 (36.4)		Fisher's exact
No	8/24 (33.3)	N/A	P = 1.00
Cigarette smoker			
Yes	10/21 (47.6)		Fisher's exact
No	2/14 (14.3)	N/A	P = 0.05*
Family history of cataract			
Yes	2/12 (16.7)		Fisher's exact
No	10/23 (43.5)	N/A	P = 0.149
Alcohol drinker			
Yes	2/5 (40.0)		Fisher's exact
No	10/30 (33.3)	N/A	P = 1.00

* denotes statistically significant levels.

TABLE 3. Percent of people with nuclear cataract by risk factor status, and associated significance testing

Potential risk factor	Number (%) who have cortical cataract	Chi-square	p-value
Gender			
Male	10/17 (58.8)		
Female	11/18 (61.1)	0.019	0.89
Race			
Malay	10/19 (52.6)		Fisher's exact
Chinese	9/11 (81.8)	N/A	P = 0.14
Use of distance correction			
Yes	14/22 (63.6)		
No	7/13 (53.8)	0.33	0.57
Diabetes			
Yes	7/14 (50.0)		
No	14/21 (66.7)	0.97	0.32
Hypertension			
Yes	11/21 (52.4)		
No	10/14 (71.4)	1.27	0.26
Heart disease			
Yes	5/9 (55.6)		
No	16/26 (61.5)	N/A	1.00
Asthma			
Yes	5/6 (83.3)		Fisher's exact
No	16/29 (55.2)	N/A	P = 0.366
Aspirin use			
Yes	3/5 (60.0)		Fisher's exact
No	18/30 (60.0)	N/A	P = 1.00
Paracetamol use			
Yes	4/11 (36.4)		Fisher's exact
No	17/24 (70.8)	N/A	P = 0.073
Cigarette smoker			
Yes	9/14 (64.3)		
No	12/21 (57.1)	0.18	0.67
Family history of cataract			
Yes	8/12 (66.7)		
No	13/23 (56.5)	N/A	0.721
Alcohol drinker			
Yes	3/5 (60.0)		
No	18/30 (60.0)	N/A	1.00

TABLE 4. Percent of people with PSC cataract by risk factor status, and associated significance testing

Potential risk factor	Number (%) who have PSC cataract	Chi-square	p-value
Gender			
Male	9/17 (52.9)		
Female	11/18 (61.1)	0.24	0.63
Race			
Malay	9/19 (47.4)		Fisher's exact
Chinese	8/11 (72.7)	N/A	P = 0.259
Use of distance correction			
Yes	13/22 (59.1)		
No	7/13 (53.8)	0.09	0.76
Diabetes			
Yes	8/14 (57.1)		
No	12/21 (57.1)	0.0	1.00
Hypertension			
Yes	15/21 (71.4)		
No	5/14 (35.7)	4.38	0.036*
Heart disease			
Yes	7/9 (77.8)		Fisher's exact
No	13/26 (50.0)	N/A	P = 0.244
Asthma			
Yes	4/6 (66.7)		Fisher's exact
No	16/29 (55.2)	N/A	P = 0.68
Aspirin use			
Yes	4/5 (80.0)		Fisher's exact
No	16/30 (53.3)	N/A	P = 0.365
Paracetamol use			
Yes	7/11 (63.6)		Fisher's exact
No	13/24 (54.2)	N/A	P = 0.721
Cigarette smoker			
Yes	6/14 (42.9)		
No	14/21 (66.7)	1.94	0.163
Family history of cataract			
Yes	7/12 (58.3)		
No	13/23 (56.5)	0.011	0.92
Alcohol drinker			
Yes	3/5 (60.0)		
No	17/30 (56.7)	N/A	1.00

* denotes statistically significant levels.

TABLE 5. Continuous variables associated with cataract

Cataract type	Age (years)	Lifetime effective ocular UV-B exposure	Near add
Cortical	T = 2.04, p = 0.05	T = 1.49, p = 0.15	T = 3.03, p = 0.005
	Yes Mean = 69.3, SD = 6.0	Mean = 52.0, SD = 24.2	Mean = 2.73, SD = 0.86
No	Mean = 62.7, SD = 13.0	Mean = 39.9, SD = 20.0	Mean = 1.52, SD = 1.49
Nuclear	T = 2.15, p = 0.04	T = 0.54, p = 0.59	T = 0.26, p = 0.79
	Yes Mean = 68.3, SD = 10.0	Mean = 45.8, SD = 21.3	Mean = 1.99, SD = 1.44
No	Mean = 59.9, SD = 12.1	Mean = 41.5, SD = 23.5	Mean = 1.86, SD = 1.44
PSC	T = -0.36, p = 0.72	T = 0.69, p = 0.50	T = -0.05, p = 0.96
	Yes Mean = 64.3, SD = 10.0	Mean = 46.4, SD = 18.9	Mean = 1.93, SD = 1.45
No	Mean = 65.8, SD = 13.5	Mean = 41.0, SD = 25.8	Mean = 1.95, SD = 1.43

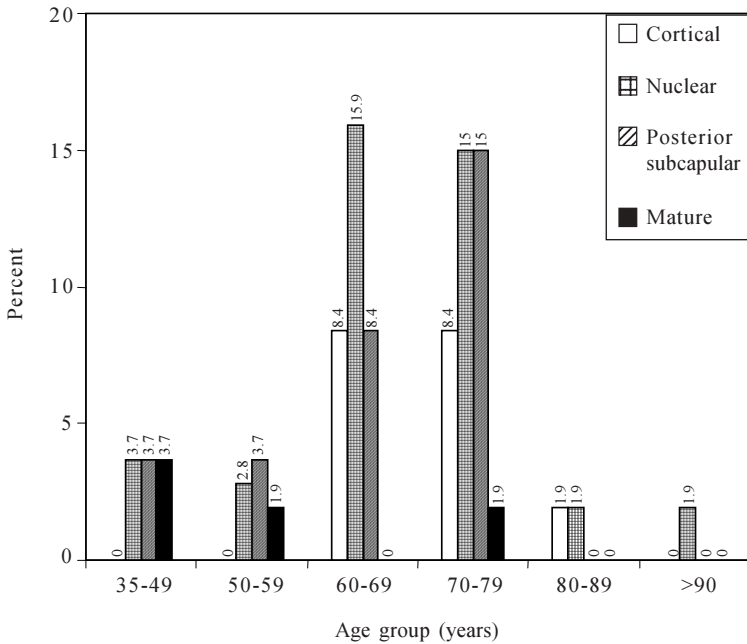


FIGURE 1. Types of cataract found for different age groups.

DISCUSSION

In this study, the small sample of patients having cataracts seen at HUKM revealed that combined nuclear and PSC cataracts, followed by pure nuclear cataracts were the more common types of cataract. Other studies have shown that cortical and nuclear cataracts were the most common forms of age-related cataracts in

the population (Sperduto & Hiller 1984; Mariani et al. 1990; Klein et al. 1992; Guiffre et al. 1995; Mitchell et al. 1997). However, this study showed that cortical cataracts were not as common but nuclear cataracts were more commonly seen. This is consistent with the results found in other studies that have found an association between darker iris colour and nuclear cataract (Leske et al. 1991; McCarty et al. 1999; The Italian-American Cataract Study Group 1991). However, the biological explanation for this finding has not been identified. A study conducted by AREDS Research Group (2001) had shown that nonwhites have more nuclear cataracts compared to whites. Results from the present study seem to be in agreement with the findings of the AREDS Research Group.

Two potential risk factors for cataract development could be identified from this study; hypertension for PSC cataract and cigarette smoking for nuclear cataract. Hypertension has been previously shown to be associated with PSC cataract and this is in agreement with the present study (Klein et al. 1995). Many studies have shown the association between cigarette smoking and nuclear cataract (Flaye et al. 1989; Leske et al. 1991; Christen et al. 1992; Hankinson et al. 1992; Klein et al. 1993; West & Valmadrid 1995; Ramakrishnan et al. 1995; Hiller et al. 1997; McCarty et al. 1999; Foster et al. 2003). The suggested mechanisms by which smoking could cause cataract include an increase in oxidative stress caused by lowering of circulating nutrients with antioxidant capabilities (Christen et al. 1992; Hankinson et al. 1992) or lens damage from by-products of smoke, such as cadmium or isocyanate (Ramakrishnan et al. 1995; Harding 1995).

Lifetime effective ocular UV-B exposures have been shown to be associated with cataract (Hollows & Moran 1981; Hiller et al. 1986; Taylor et al. 1988; Cruickshanks et al. 1992; West & Valmadrid 1995; West et al. 1998; Foster et al. 2003). Many studies have shown that after middle age, the eye's natural enzymatic and antioxidant protection against ultraviolet-radiation-induced damage was lost and at the same time there was an increase in the production of the photochemically active chromophores, N-formyl kynurenine and xanthurenic acid. As the lens absorbs ambient light, these chromophores were activated, and the lens proteins (α , β , γ crystallins) became denatured with a resultant loss of transparency (Malina & Martin 1996; Roberts et al. 2000; Balasubramanian 2000). In this study, although lifetime effective ocular UV-B exposure was found to be not a significant potential risk factor, perhaps because of the small number of subjects, but it was seen that for cortical cataracts, the mean difference of lifetime effective ocular UV-B exposure between those with cortical and those without cortical cataracts was larger compared to others with and without nuclear cataracts and posterior subcapsular cataracts.

Many studies have shown that women have a slight excess risk of cataract (Hiller et al. 1986; Leske et al. 1991; Klein et al. 1992; Ramakrishnan et al. 1995; Mitchell et al. 1997; McCarty et al. 1999) but one study showed no significant gender difference (Foster et al. 2003). In this study also, no association could be established with gender. Previous studies have found diabetes (McCarty et al. 2000; Leske et al. 2002; Foster et al. 2003), arthritis (McCarty et al. 2000), thiazide

diuretic use (McCarty et al. 2000), and use of thyroid hormones (AREDS 2001), to be risk factors for cataract development. This could not be shown in this study perhaps because of the small sample of patients studied.

CONCLUSION

This study showed that cigarette smoking, hypertension and exposure to UV light were risk factors for development of cataracts. Patients with hypertension should be alerted for changes in their vision associated with cataracts. This data also supports for public health campaigns to decrease the prevalence of smoking in the community and to increase ocular protection from UV light by avoiding the midday sun and using sunglasses with UV protection coating.

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Sharanjeet-Kaur
 Arifah Nur Yahya
 Department of Optometry
 Faculty of Allied Health Sciences
 Universiti Kebangsaan Malaysia
 Jalan Raja Muda
 50300 Kuala Lumpur, Malaysia

Che Muhaya Mohamad
 Department of Ophthalmology
 Faculty of Medicine
 Universiti Kebangsaan Malaysia
 Jalan Yaacob Latif, Bandar Tun Razak
 56000 Kuala Lumpur, Malaysia.

McCarty, C.A.
 Marshfield Medical Research Institute
 Marshfield
 United States of America.