ORIGINAL ARTICLE

Prevalence of Eye Diseases of the Elderly in University Eye Clinic

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Objective: To assess the prevalence of eye diseases among elderly receiving care at a University Healthcare eye service.

Materials and Methods: A retrospective review of medical records was conducted for elderly patients attending Rangsit University Healthcare's eye services between 2020 and 2021. Data collected included age, gender, underlying systemic diseases, refraction data, and results of comprehensive eye examinations. Logistic regression analysis was performed to investigate the associations between age, gender, and eye diseases.

Results: Out of 22,563 patients that attended the eye service, 1,452 were aged 60 years and older. The most common eye diseases observed were uncorrected refractive errors at 71.14%, followed by cataracts including pseudophakia at 69.77%, glaucoma at 21.9%, and posterior vitreous detachment at 14.6%. Additionally, pinguecula, pterygium, and lid disorders were presented in 10.67% of cases, dry eye 8.47%, retinal breaks 6.89%, epiretinal membrane 5.85%, diabetic retinopathy 4.75%, and age-related macular degeneration 4.13%. The prevalence of retinal breaks, epiretinal membrane, diabetic retinopathy, age-related macular degeneration, glaucoma, and corneal diseases increased with age while pinguecula, pterygium, and lid disorders showed an inverse association with age. Cataracts, posterior vitreous detachment, and dry eyes were more common in women, whereas, pinguecula, pterygium, lid disorders, and corneal diseases were more prevalent in men. Refractive error, glaucoma, and age-related macular degeneration showed no gender difference. Compared to the previous national surveys in Thailand, posterior segment eye diseases were more prevalent in the present study.

Conclusion: Uncorrected refractive errors, cataracts, and glaucoma were the most prevalent eye diseases observed in the elderly patients, consistent with the previous national surveys. However, the present study identified an increased prevalence of posterior segment eye diseases. Early screening and referral by optometrists for timely treatment by ophthalmologists are crucial in preventing visual loss and achieving better visual outcomes while optimizing resource utilization.

Keywords: Prevalence; Eye diseases; Elderly; University eye clinic

Received 25 January 2024 | Revised 21 March 2024 | Accepted 2 April 2024

J Med Assoc Thai 2024;107(5):309-15

Website: http://www.jmatonline.com

The United Nations defines individuals aged 60 and above as elderly, yet many developing countries set the threshold at 65 years. In Thailand, individuals over 60 years old with Thai nationality are classified as elderly according to the law.

As individuals age, every organ becomes increasingly vital, including the visual system. Beyond refractive errors, aging can lead to various eye conditions such as cataracts, glaucoma, and age-related macular degeneration (AMD). Additionally, non-communicable diseases like diabetes mellitus, hypertension and hyperlipidemia can contribute to diabetic retinopathy (DR) and retinal vascular diseases[1].

Studies from around the world have shed light on the prevalence of eye diseases in aging populations. For instance, a 2004 study from Taiwan focusing on those over 65 years old reported a prevalence of 41.7% for cataracts, 12.5% for myopic macular degeneration (MMD), and 0.4% for AMD[2]. Similarly, research from Korea in 2011, utilizing data from the National Health and Nutrition Survey 2008-2009, found cataracts in 40.2% of participants, pterygium in 8.9%, AMD in 5.6%, DR in 13.4%, and glaucoma in 2.1%[3]. Other studies, such as one conducted in Iran in 2012, examined 446 individuals aged 50 and older, identifying cataracts in 11.9%, retinopathy in 3.8%, aphakia in 2.7%, retinal detachment in 1.6%, glaucoma in 0.4%, and AMD in 0.6%[4]. Moreover, a 2017 report from North Iran,

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How to cite this article:

Chaisiri P, Vincent JE, Jenchitr W, Yospaiboon Y. Prevalence of Eye Diseases of the Elderly in University Eye Clinic. J Med Assoc Thai 2024;107:309-15. DOI: 10.35755/jmedassocthai.2024.5.13982

Table 1. Elderly patients attending RSU Healthcare during 2020-2021

Age range (years)	Elderly patients			Complete refraction			Complete eye examination		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
60 to 69	554	607	1,161	356	380	736	422	465	887
70 to 79	228	296	524	148	219	367	166	230	396
≥80	114	142	256	49	115	164	63	106	169
Total	896	1,045	1,941	553	714	1,267	651	801	1,452

utilizing a cross-sectional study with randomized cluster sampling and involving 1,185 cases aged 55 to 87 years, found cataracts in 29.6%, AMD in 5.8%, glaucoma in 3.7%, and DR in 3.7%[5].

In Thailand, studies explored the prevalence of eye diseases, with the most recent being in 2006-2007[6]. Additionally, a Rapid Assessment of Avoidable Blindness (RAAB) was conducted in 2014 among those aged 50 and older[7]. However, none of these studies specifically focused on eye diseases in the elderly population[2-8]. Therefore, the present study aimed to fill this gap by assessing the prevalence of eye diseases specifically among elderly individuals.

Materials and Methods

The present study was an observational study. It received approval from the Rangsit University Ethical Review Board (RSU-ERB2022 160 0709). Medical records of elderly patients attending Rangsit University Healthcare Eye Services between 2020 and 2021 were retrospectively reviewed. Although patients' consent to review their medical records was not required by the Ethics Committee, data were de-identified and patient data confidentiality was protected. Data collected included age, gender, underlying systemic diseases, refraction data, primary eye disease screening by optometrists, and results of comprehensive eye examinations, treatment, and follow-up by ophthalmologists. AMD was diagnosed utilizing the international classification and grading system for age-related maculopathy and AMD[9]. DR was diagnosed based on the definitions provided by the early treatment diabetic retinopathy study (ETDRS)[10,11] and Thailand protocol[12,13]. Glaucoma diagnosis was determined by using Foster's criteria, with clinical changes in optic disc and visual field assessments[14,15].

Statistical analysis

All analyses were performed with IBM SPSS Statistics, version 22.0 (IBM Corp., Armonk, NY, USA). Categorical outcomes were presented as numbers and percentages, whereas numerical outcomes were presented as mean and standard deviation. Logistic regression analysis was conducted to explore associations between age, gender, and eye diseases. A p-value of less than 0.05 was considered statistically significant.

Results

Among the 22,563 patients attending the eye service, 1,452 were aged 60 years and older. The mean age was 69.6±8.09 years (range 60 to 101) and a male-to-female ratio of 651 to 801. Refraction was performed in 1,267 patients (87.26%), while all 1,452 cases undergone complete eye examinations (Table 1). The number and prevalence of eye diseases in elderly patients were compared among age groups (Table 2). Additionally, eye diseases in the elderly were compared between genders (Table 3).

Cataract

One thousand thirteen cases of cataract (69.76%) were identified, with 301 cases (29.71%) involving pseudophakia. Most unoperated cataracts were incipient, potentially improving with refraction. There was a significant association between cataract and age group ($p<0.001$). Individuals aged 70 to 79 years had 5.5 times more cataracts than those aged 60 to 69 years, while those aged 80 years and above had 8.9 times more cataracts (Table 2). Female gender was associated with a higher prevalence of cataracts than male gender ($p=0.005$), with females having over 1.4 times the prevalence (Table 3).

Glaucoma

There were 318 cases of glaucoma (21.9%). Among these, 206 cases were actively treated, with 129 cases of primary open-angle glaucoma (POAG) and 46 cases of normal-tension glaucoma (NTG). The prevalence of POAG among glaucoma cases was 85% or 12% of the total patients. Primary angle-closure glaucoma comprised only 18 cases or 8.7% of glaucoma cases. Peripheral laser iridotomy was performed in 96 cases of PACG and primary angle-closure suspected. Thirteen cases of secondary

Table 2. Eye diseases in the elderly patients compared among age groups

Eye diseases	Total (1,452) n (%)	60-69 years (887) n (%)	70-79 years (396) n (%)	≥80 years (169) n (%)	Odds ratio (95% CI)	p-value
Uncorrected refractive error*	1,033 (71.14)	595 (80.84)	313 (85.29)	125 (76.22)	1.81 (1.14 to 2.87)	0.036
Cataract and pseudophakia	1,013 (69.77)	508 (57.27)	349 (88.13)	156 (92.31)	8.95 (5.01 to 16.01)	<0.001
Glaucoma	318 (21.90)	140 (15.78)	111 (28.03)	67 (39.64)	3.51 (2.45 to 5.01)	<0.001
Posterior vitreous detachment	212 (14.60)	122 (13.75)	67 (16.92)	23 (13.61)	1.29 (0.78 to 2.16)	0.310
Pinguecula, pterygium, and lid diseases	155 (10.67)	117 (13.19)	28 (7.07)	10 (5.92)	2.42 (1.24 to 4.71)	0.001
Dry eyes	123 (8.47)	66 (7.44)	39 (9.85)	18 (10.65)	1.48 (0.86 to 2.57)	0.202
Retinal break and macular hole	100 (6.89)	47 (5.30)	37 (9.347)	18 (10.65)	2.13 (1.21 to 3.77)	0.006
Epiretinal membrane	85 (5.85)	32 (3.61)	32 (8.08)	21 (12.43)	3.79 (2.13 to 6.75)	<0.001
Diabetic retinopathy	69 (4.75)	30 (3.38)	12 (3.03)	27 (15.98)	5.43 (3.14 to 9.41)	<0.001
Age-related macular degeneration	60 (4.13)	17 (1.92)	14 (3.54)	29 (17.16)	10.6 (5.68 to 19.80)	<0.001
Corneal diseases	35 (2.41)	14 (1.58)	15 (3.79)	6 (3.55)	2.46 (1.17 to 5.14)	0.042
Myopic macular degeneration	16 (1.1)	6 (0.41)	7 (0.48)	3 (0.21)	2.654 (0.66 to 10.72)	0.236

CI=confidence interval

* Uncorrected refractive error calculated sample size was 1,267

Table 3. Eye diseases in the elderly by genders

Eye diseases	Total (1,452); n (%)	Female (788); n (%)	Male (664); n (%)	Odds ratio (95% CI)	p-value
Uncorrected refractive error*	1,033 (81.53)	591 (82.77)	442 (79.93)	0.83 (0.62 to 1.10)	0.196
Cataract and pseudophakia	1,013 (69.77)	574 (72.84)	439 (66.11)	1.38 (1.10 to 1.72)	0.005
Glaucoma	318 (21.90)	177 (22.46)	141 (21.23)	1.08 (0.84 to 1.38)	0.573
Posterior vitreous detachment	212 (14.60)	152 (19.29)	60 (9.04)	2.41 (1.75 to 3.31)	<0.001
Pinguecula, pterygium, lid diseases	155 (10.67)	71 (9.01)	84 (12.65)	1.46 (1.05 to 2.04)	0.026
Dry eyes	123 (8.47)	90 (11.42)	33 (4.97)	2.47 (1.63 to 3.73)	<0.001
Retinal breaks (include macular hole)	102 (7.02)	61 (7.74)	41 (6.17)	1.28 (0.85 to 1.92)	0.246
Epiretinal membrane	85 (5.85)	52 (6.60)	33 (4.97)	1.35 (0.86 to 2.12)	0.189
Diabetic retinopathy	69 (4.75)	37 (4.70)	32 (4.82)	1.03 (0.63 to 1.67)	0.912
Age-related macular degeneration	60 (4.13)	38 (4.82)	22 (3.31)	1.48 (0.87 to 2.53)	0.152
Corneal diseases	35 (2.41)	13 (1.65)	22 (3.31)	2.04 (1.02 to 4.09)	0.044
Myopic macular degeneration	16 (1.1)	7 (0.89)	9 (1.36)	1.53 (0.57 to4.14)	0.139

CI=confidence interval

* Uncorrected refractive error calculated sample size was 1,267

glaucoma, primarily from uveitis, were identified, comprising 6.3% of glaucoma cases or 0.9% of the total cases. Only 16 glaucoma patients (7.8% of total glaucoma) underwent trabeculotomy and selective laser trabeculoplasty. Glaucoma demonstrated a significant association with age group (p<0.001), with individuals aged 80 years and above had 3.5 times more glaucoma than those aged 60 to 69 years (Table 2). However, there was no association between glaucoma and gender (p=0.573) (Table 3).

Posterior vitreous detachment (PVD)

PVD was the most common posterior segment disease, with 212 cases identified. There was no significant association with age group (p=0.310) (Table 2), but a significant association with gender was observed (p<0.001), with females having 2.4 times the prevalence compared to males (Table 3).

Pinguecula, pterygium, and lid disorders

These anterior segment eye diseases comprised 155 cases (10.7%). They were associated with age group (p=0.001), with younger age groups having a higher prevalence (Table 2). Additionally, there was a significant association with gender (p<0.026), with males having 1.5 times the prevalence compared to females (Table 3).

Dry eye

One hundred twenty-three cases (8.5%) of dry eye were identified. There was no association with age group (p=0.202) (Table 2), but a significant

Table 4. Prevalence of major eye diseases by age group, compared between 2007 and this study

Age range (years)	Number of samples in 2007	Prevalenc:100 of eye diseases in 2007; % (n)				Number of samples in 2021	Prevalence:100 of eye diseases in 2021; % (n)			
		Cataract	Glaucoma	AMD	DR		Cataract	Glaucoma	AMD	DR
60 to 69	3,502	43.37 (1,519)	5.71 (200)	3.40 (119)	3.06 (139)	887	57.27 (508)	15.78 (140)	1.92 (17)	3.38 (30)
70 to 79	2,044	65.31 (1,335)	6.60 (135)	4.06 (83)	2.15 (44)	396	88.13 (349)	28.03 (112)	3.54 (14)	3.03 (12)
80 and above	365	64.65 (236)	7.40 (27)	6.30 (23)	1.37 (5)	169	92.31 (156)	39.64 (67)	17.16 (29)	16.00 (27)

AMD=age-related macular degeneration; DR=diabetic retinopathy

association with gender was observed (p<0.001), with females having 2.5 times the prevalence compared to males (Table 3).

Retinal tear, hole, lattice with thinning, macular hole

One hundred two cases (7%) of retinal pathologies were identified. They were associated with age group (p=0.006), with older age groups having a higher prevalence. Patients aged 70 to 79 years, 80 years and above had 1.6 times and 2.1 times more retinal breaks than those aged 60 to 69 years (Table 2). However, there was no association with gender (p=0.246) (Table 3).

Epiretinal membrane (ERM)

Eighty-five cases of ERM were identified, with a significant association with age group (p<0.001). Individuals aged 70 to 79 years and 80 years and above had 2.3 times and 3.8 times more ERM than those aged 60 to 69 years (Table 2). However, there was no association with gender (p=0.189) (Table 3).

Diabetic retinopathy (DR)

Sixty-nine cases (4.8%) of DR were identified, representing 31.08% of diabetic patients in the present study. There was a significant association with age group (p<0.001), with older age groups having a higher prevalence. Individuals aged 80 years and above had 5.4 times more DR than those aged 60 to 69 years (Table 2). However, there was no association with gender (p=0.912) (Table 3).

Age-related macular degeneration (AMD)

Sixty cases (4.1%) of AMD were identified, with a significant association with age group (p<0.001). Patients aged 80 years and above had 10.6 times more AMD than those aged 60 to 69 years (Table 2). However, there was no association with gender (p=0.152) (Table 3).

Keratitis, corneal opacity, and corneal dystrophy

Twenty-eight cases (1.93%) of corneal diseases were identified, with significant associations with both age group (p=0.04) and gender (p=0.044).

Myopic macular degeneration (MMD)

The present study first reported MMD as eye disease of the elderly in Thailand. MMD showed no association with either age group (p=0.236) or gender (p=0.139).

Treatment of eye diseases in the elderly

Surgical and laser treatments were considered in the present study. Cataract extraction with intraocular lens implantation was the most common procedure, followed by laser peripheral iridotomy. Laser retinopexy for retinal tear, hole, and DR was performed in 4.48% of cases. Intravitreous injection of anti-vascular endothelial growth factor was performed in 1.2% of cases. Vitreo-retinal surgery was performed in 2% of cases. Glaucoma treatment involved medication in most cases, with only 1.1% undergone glaucoma surgery or selective laser trabeculoplasty.

Comorbidity of medical diseases

Hypertension was the most common medical condition at 26%, followed by dyslipidemia at 17.4%, diabetes at 15.2%, and cardiovascular disease at 4.6%. POAG was associated with hypertension (p=0.035), with 21.4% of POAG cases having hypertension. NTG was found in individuals with diabetes, hypertension, and dyslipidemia in 23.4%, 34%, and 19.1%, respectively, but these comorbidities showed no significant association with NTG.

When comparing the data of elderly individuals from the national survey conducted in 2007 with the findings of the present study, it was observed that cataracts and glaucoma were more prevalent in the present study across all age groups (Table 4, 5). Additionally, individuals aged 80 years and above in the present study exhibited significantly higher rates of AMD and DR compared to those in the national survey (Table 5).

Table 5. Comparison of major eye diseases between National Survey (2007) and this study

Eye disease	Age range (year)	National survey (2007) Prevalence:100	University eye clinic (2021) Prevalence:100	Statistic and interpretation
Cataract	60 to 69	43.37	57.27	The elderly in 2021 had 1.75 times more cataract than the elderly in 2007 (p<0.001)
	70 to 79	65.31	88.13	The elderly in 2021 had 3.94 times more cataract than the elderly in 2007 (p<0.001)
	80 and above	64.65	92.31	The elderly in 2021 had 6.56 times more cataract than the elderly in 2007 (p<0.001)
Glaucoma	60 to 69	5.71	15.78	The elderly in 2021 had 3.09 times more glaucoma than the elderly in 2007 (p<0.001)
	70 to 79	6.60	28.03	The elderly in 2021 had 5.51 times more glaucoma than the elderly in 2007 (p<0.001)
	80 and above	7.40	39.64	The elderly in 2021 had 8.223 times more glaucoma than the elderly in 2007 (p<0.001)
AMD	60 to 69	3.40	1.92	The elderly in 2007 had 1.8 times more AMD than the elderly in 2021 (p=0.025)
	70 to 79	4.06	3.54	The elderly in 2007 and 2021 were not significantly different (p=0.625)
	80 and above	6.30	17.16	The elderly in 2021 had 3.08 times more AMD than the elderly in 2007 (p<0.001)
DR	60 to 69	3.06	3.38	The elderly in 2007 and 2021 were not significantly different (p=0.418)
	70 to 79	2.15	3.01	The elderly in 2007 and 2021 were not significantly different (p=0.288)
	80 and above	1.37	16.00	The elderly in 2021 had 13.69 times more DR than the elderly in 2007 (p<0.001)

AMD=age-related macular degeneration; DR=diabetic retinopathy

Discussion

The most common eye disease in the present study was uncorrected refractive error, consistent with findings from the Khalaj et al. and Fotouhi et al. study[4,16] conducted in Iran. Previous research had indicated that failure to correct refractive errors in the elderly can lead to visual impairment, significantly impacting their quality of life[17]. In Thailand, over the past two decades, the elderly had to purchase their eyeglasses as they were not provided by the healthcare services. However, there has been a positive shift as local administrations now offer free eyeglasses to the elderly, although there are currently no standardized pricing guidelines or clear protocols regarding the frequency of obtaining new pairs. Nonetheless, this represents a significant advancement in refractive error services for the elderly in Thailand. Those whose vision does not improve with eyeglasses can seek consultation with ophthalmologists for further screening of eye diseases.

Cataract emerged as the second most common eye disease in the present study. In the fourth National Survey conducted in 2007[6], cataracts were the most prevalent eye diseases, due to lesser emphasis on refractive errors during that period. The service plans implemented by the National Health Security Office and the Ministry of Public Health now offer free services to the elderly, ensuring easy accessibility, reduced waiting times, and stringent quality control during reimbursement. Patients undergoing cataract surgery should not incur costs for mono-focal intraocular lenses, and healthcare personnel should inform them and their relatives about this government provision to alleviate financial burdens. Additionally, if the first eye operated on does not yield satisfactory results due to comorbidities such as glaucoma, DR, or AMD, healthcare professionals should educate patients and their families to prevent refusal of surgery for the other eye.

Glaucoma remains a leading cause of irreversible blindness[18]. Given its lifelong treatment requirement, patients and their families face substantial direct and indirect costs compared to other eye diseases. Glaucoma screening is recommended for individuals over 40 years old, particularly during their initial refraction for presbyopia and each time they update their eyeglasses, especially in cases of myopia. Previous studies have linked myopia to glaucoma[19], and NTG was associated with diabetes, hypertension, and hyperlipidemia[18]. Although this association was not found in the present study, it was noteworthy for future research.

Posterior segment eye diseases were also reported as eye diseases of the elderly in the present study. Some diseases were non-severe, such as PVD, while others were severe retinal diseases requiring substantial resources for treatment, such as proliferative DR, AMD, macular hole, and branch retinal vein occlusion. It would be beneficial to implement primary eye care screening to enable early diagnosis and timely treatment for these conditions. Although, efforts to establish retinal services in regional and provincial hospitals are underway, some patients still require referrals to larger medical centers due to resource limitations.

Other retinal diseases such as ERM and MMD were also observed, with varying prevalence compared to international studies. The prevalence of ERM in the present study was lower than that reported in Australia[20,21], Mitchell et al.[20] reported that ERM was associated with PVD and more ERM as the patient got older and female predilection. However, the present study showed no association with PVD and no gender difference in ERM. Utilization of technologies like optical coherence tomography aids in early diagnosis and timing of surgical interventions for conditions like ERM[22]. While MMD was previously unreported as an eye disease of the elderly in Thailand, its prevalence here aligns with global trends[23,24]. Notably, MMD showed no association with age or gender in the present study.

Interestingly, the present study noted a higher prevalence of posterior segment eye diseases compared to the previous reports[6,7]. This could be attributed to the middle and upper-income status of the patients, enabling better access to eye healthcare and treatment of anterior segment diseases. Primary eye care screening by trained personnel could facilitate early diagnosis, reduce treatment burden, and improve outcomes. Regular check-ups for non-communicable diseases such as diabetes mellitus and hypertension are also recommended, as they can contribute to conditions like DR and retinal vascular occlusions.

Limitations of the present study include its hospital-based nature, potentially leading to an overestimation of eye disease prevalence compared to population-based national surveys. These hospital-based results cannot be representative of the general population and therefore limit the generalizability of the findings. Additionally, its retrospective design may have resulted in missing data, although efforts were made to minimize this by excluding incomplete records. This led to a decrease in the total number of recruited medical records and the number of patients in each subgroup being too small to observe statistically significant differences. Nonetheless, the present study provides valuable insights for future research, and further national surveys are recommended.

Conclusion

Uncorrected refractive errors, cataracts, and glaucoma remain prevalent among the elderly, consistent with the previous national surveys. However, the present study highlights an increased prevalence of posterior segment eye diseases such as AMD and DR. The emergence of MMD underscores the importance of early screening and timely treatment by ophthalmologists, particularly as myopia rates rise. Vigilant monitoring of eye disease rates among the elderly is crucial, with population-based surveys aiding in service planning. Ophthalmologists and optometrists should prioritize early detection of age-related conditions for improved clinical outcomes. Encouraging routine eye and health care among the elderly through health messaging is imperative for preserving vision and enhancing overall well-being.

What is already known on this study?

As Thailand's population aged, there is a notable shift towards non-communicable diseases associated with eye diseases and vision loss. Understanding the prevalence of eye diseases among elderly Thais is crucial.

What does this study add?

This study investigates the prevalence of eye diseases among Thai elderly, revealing increased prevalence of posterior segment eye diseases, particularly AMD, DR, and emerging conditions like MMD. These findings suggest an increasing risk of blindness and vision impairment among Thailand's elderly population. Regular monitoring and strategic planning of eye care services are essential, emphasizing the importance of routine eye and health care for the elderly.

Availability of data

The data used to support the findings of the present study are available upon request from the corresponding author.

Funding disclosure

This study was support by the Research Institute of Rangsit University of Thailand (October 31, 2022).

Conflicts of interest

The authors declare no conflict of interest.

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