

## Original Research Article

### Prevalence of Coexisting Systemic and Ocular Diseases among Cataract Surgery Patients: A Study in a Teaching Hospital in North East Malaysia

#### Author's Contribution:

The sole author has designed the concept, performed the literature search collected and analyzed the data, and prepared the draft and final version of the manuscript.

#### ABSTRACT

**Aim:** To determine the prevalence of coexisting systemic and ocular diseases among the cataract surgery patients in a teaching hospital in north east Malaysia.

**Method:** in this retrospective study, the medical records of patients who were operated for cataract over a period of three years by a single surgeon in the teaching Hospital University Sains Malaysia were analyzed for the coexisting systemic and ocular diseases. Some patients were operated in both eyes.

**Results:** Out of 218 patients who underwent cataract surgery, one or more systemic diseases were present in 113 patients (51.8%). The most common associated systemic disease was diabetes mellitus (24.3%), followed by hypertension (22.4%). A total of 324 eyes were operated in these patients. In addition to cataract, one or more ocular diseases were present in 129 eyes (39.8%). The most common ocular disease in cataract eyes was pterygium (9.8%), followed by diabetic retinopathy (8.9%).

**Conclusion:** Ophthalmologist has to identify the coexisting systemic and ocular diseases present among cataract surgery patients. These diseases should be adequately controlled before surgery in order to avoid intraoperative and postoperative complications, and to achieve better quality of life for the patients..

**Keywords:** *Cataract; diabetes mellitus; hypertension; ischemic heart disease; pterygium; open angle glaucoma; diabetic retinopathy; age related macular degeneration.*

#### INTRODUCTION

Globally, the leading causes of vision impairment are uncorrected refractive errors and cataracts. The majority of people with vision impairment are over the age of 50 years [1]. Excellent potential for good visual outcome (6/12 or better) has been reported after cataract extraction and intraocular lens implantation in the developed [2] and developing countries [3]. Cataract surgery is one of the most common and safe ophthalmic operation performed all over the world. Presence of preoperative systemic and ocular diseases can have a significant effect on the outcomes of cataract operation [4].

The literature search revealed varying prevalence of preoperative coexisting systemic diseases in cataract patients ranging from 32.81% to 92.52%% in different countries [5-12]. There is a need for extra health care services and availability of resources for cataract patients with systemic comorbidities. Wide range of prevalence of coexisting ocular diseases in cataract operated patients (8.0% - 71.81%) has been reported from different countries [5-10,12]. The associated ocular diseases should be treated adequately before undertaking cataract surgery to avoid intraoperative and postoperative complications and to achieve useful vision after the operation.

41 The literature search revealed only one report from Ministry of Health Malaysia hospital [10] in which the  
42 data of Melaka hospital were taken from the national cataract surgery registry and analyzed for the  
43 coexisting systemic and ocular diseases along with many other variables. Therefore, this retrospective  
44 study was undertaken to determine the prevalence of coexisting systemic and ocular diseases among the  
45 cataract operated patients in a teaching university hospital in north east Malaysia.

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## 48 MATERIAL AND METHODS

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50 Kelantan is one of the states located in north east Malaysia with population of 1.86 million (0.94 million  
51 males and 0.92 million females) [13]. It is an agricultural state and majority of people live in rural areas.  
52 There are two tertiary hospitals in this state viz Hospital Kota Bharu (ministry of health state hospital) and  
53 Hospital University Sains Malaysia (teaching hospital of School of Medicine, University Sains Malaysia in  
54 Kubang Kerian, Kota Bharu district). The patients from different health centres of the state are referred for  
55 cataract surgery to these two hospitals.

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57 In this retrospective study, the medical records of cataract patients operated, over a period of three years, in  
58 the teaching University Sains Malaysia hospital were reviewed for the coexisting systemic and ocular  
59 diseases. There were six medical lecturers and ten postgraduate students in the ophthalmology department  
60 of the teaching hospital. The operation days were twice a week and thus the theatre facilities were shared  
61 by three specialists and five postgraduate students on each day.

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63 Two hundred and eighteen patients aged above 50 years with cataract causing visual disability in daily  
64 occupational work and scheduled for surgery were included in this study. Those patients with traumatic  
65 cataract, eyes with signs of inflammation, and eyes with no perception of light were excluded. The gender,  
66 age and race of patients, eye operated, coexisting systemic and ocular diseases were noted. Cases  
67 operated by a single surgeon (author) only were included in this study. After the routine work up, informed  
68 consent was taken for surgery. Standard microsurgical procedure of exrcapsular cataract extraction with  
69 polymethyl methacrylate posterior chamber intraocular lens implantation was performed in all the patients  
70 under infiltration local anaesthesia.

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72 The data variables were analyzed by SPSS programme using version 16 software. Categorical variables  
73 were presented as frequencies (%). Prevalence rates for systemic diseases were person specific and ocular  
74 diseases were eye specific.

75

## 75 RESULTS

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77 Out of 218 patients who underwent cataract surgery, females were slightly more (52.3%) than males  
78 (47.7%). Majority of patients were Malays (70.6%). Nearly three-fourths (73.4%) of patients were above the  
79 age of 60 years. A total of 324 eyes were operated; 106 patients underwent operation in both eyes (Table1).  
80 One or more coexisting systemic diseases were present in 113 out of 218 cataract patients (51.8%). The  
81 most common systemic disease was diabetes mellitus (24.3%), followed by hypertension (22.4%), and  
82 ischemic heart disease (4.5%), Table 2. In addition to cataract, one or more coexisting ocular diseases

83 were present in 129 out of 324 eyes (39.8%). The most common ocular disease was pterygium (11.1%),  
 84 followed by diabetic retinopathy (8.9%) and open angle glaucoma (7.1%), Table 3.

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 86

87 **Table 1. Demographic characteristics of cataract patients (n=218)**

88	<b>Parameter</b>	<b>Number</b>	<b>Percentage</b>
89	<b>Gender</b>		
90	Male	104	47.7%
91	Female	114	52.3%
92	<b>Age</b>		
93	51 – 60 years	58	26.6%
94	61 – 70 years	94	43.1%
95	71 – 80 years	58	26.6%
96	81 – 90 years	8	3.7%
97	<b>Race</b>		
98	Malay	154	70.6%
99	Chinese	52	23.8%
100	Indian	12	5.5%
101	<b>Eye operated</b>		
102	Right eye	62	28.4%
103	Left eye	50	22.9%
104	Both eyes	106	48.6%

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107 **Table 2. Coexisting systemic diseases in cataract patients (n=218)\***

108	<b>Systemic disease</b>	<b>Number</b>	<b>Percentage</b>
109	Diabetes mellitus	53	24.3%
110	Hypertension	49	22.4%
111	Ischemic heart disease	10	4.5%
112	Asthma	8	3.6%
113	Leprosy	3	1.4%
114	Gout	3	1.4%
115	Hemiplegia	3	1.4%
116	Tuberculosis	2	0.9%
117	Hyperthyroidism	2	0.9%
118	Syphilis	1	0.4%
119	Breast carcinoma	1	0.4%
120	Non Hodgkins lymphoma	1	0.4%

121 \* some patients had more than one associated systemic disease.

122

123 **Table 3. Coexisting ocular diseases in cataract eyes (n=324 eyes)\***

124	Eye disease	Number	Percentage
125	Pterygium	32	9.8%
126	Diabetic retinopathy	31	9.5%
127	Open angle glaucoma	23	7.1%
128	Central corneal opacity	14	4.3%
129	Pseudo exfoliation of lens	8	2.4%
130	Hypertensive retinopathy	6	1.8%
131	Myopic degeneration	6	1.8%
132	Acute congestive glaucoma	6	1.8%
133	Chronic dacryocystitis	4	1.2%
134	Age related macular degeneration	4	1.2%
135	Retinitis pigmentosa	2	0.6%
136	Divergent squint	2	0.6%
137	Healed central choroiditis	2	0.6%
138	Optic atrophy	2	0.6%
139	Macular hole	1	0.3%
140	Coloboma of iris	1	0.3%

141 \* some eyes had more than one associated eye disease.

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## 144 **DISCUSSION**

145 Cataract is the most common cause of preventable blindness in the world. Most of these patients are elderly  
 146 and are likely to have various associated systemic diseases. Preoperative assessment is important to  
 147 determine the prevalence of systemic diseases to prevent preoperative, operative and postoperative  
 148 complications and mortality in patients undergoing cataract surgery. Persons undergoing cataract extraction  
 149 may have higher mortality than patients of comparable age, sex and race undergoing other surgical  
 150 procedures [14].

151 The prevalence of systemic comorbidities in the present study (51.8%) is higher than the figures reported in  
 152 some studies [6,11,12] and lower than other studies reported from different countries (Table 4).

153 **Table 4. Prevalence of systemic diseases in cataract patients in different countries**

154	Author	Place &	Total No.of	Systemic
155		country	patients	comorbidities
156	Arthur et al [5]	Pondichery, India	448	32.81%
157	Shrestha et al [6]	Pokhara, Nepal	675	59.4%
158	Riley et al [7]	Auckland, New Zealand	480	80.0%
159	Pham et al [8]	Sydney, Australia	615	92.52%
160	Abdelmoaty et al [9]	Kuwait, Kuwait	325	61.5%
161	Thevi & Godinho [10]	Melaka, Malaysia	12992	33.79%

162	Ram et al [11]	Chandigarh, India	6103	17.2%
163	Al- Qahtani et al [12]	Riyadh, Saudi Arabia	421	82.66%
164	PRESENT STUDY	Kelantan, Malaysia	218	51.8%%

165

166 The percentage of the common systemic diseases that include diabetes mellitus, hypertension and heart  
 167 disease (ischemic heart diseases, angina, myocardial infarction, cardiac arrhythmia, cardiac failure)  
 168 reported from different countries in cataract patients is shown in Table 5.

169 **Table 5. Frequency of common systemic diseases in cataract patients in different countries**

170	Author	Diabetes mellitus	Hypertension	Heart disease	Asthma
171	Arthur et al [5]	13.62%	9.38%	1.12%	1.79%
172	Shrestha et al [6]	14.7%	17.8%	7.7%	---
173	Riley et al [7]	20.41%	45.83%	22.5%	11.25%
174	Pham et al [8]	27.47%	56.26%	35.12%	12%
175	Abdelmoaty et al [9]	37.53%	36.3%	15.38%	---
176	Thevi & Godinho [10]	42.30%	55.23%	9.93%	3.3%
177	Ram et al [11]	3.75%	2.7%	1.39%	3.67%
178	Al- Qahtani et al [12]	61.04%	64.13%	15.67%	10.45%
179	PRESENT STUDY	24.3%	22.4%	4.5%	3.6%

180

181 The following are the probable factors for the varied prevalence of coexisting systemic diseases in the  
 182 population in different countries: (1) genetic and racial predisposition for disease --- diabetes, coronary  
 183 heart disease, (2) socioeconomic status, physical inactivity and eating habits of different groups of people ---  
 184 diabetes, hypertension, ischemic heart disease, (3) environmental air pollution --- asthma, and (4) obesity  
 185 and hyperlipidemia --- diabetes, hypertension, ischemic heart disease, (5) availability of good health care  
 186 facilities for prevention, early diagnosis and treatment --- more detection of these diseases in the population.  
 187 The frequency of different diseases depends on the number of patients examined in the study.

188 Cataracts in patients with diabetes most commonly present as cortical or posterior subcapsular cataracts  
 189 that occur at an earlier age in patients with poor blood sugar control as compared to age-matched controls.  
 190 These cataracts often progress more rapidly and are more closely related to poor glucose control than  
 191 duration of the disease. Classic diabetic cataracts consist of snowflake cortical opacities that may either  
 192 resolve spontaneously or mature rapidly within a short period of time. These cataracts occur due to a high  
 193 level of glucose present in the aqueous humor, which diffuses into the lens. Within the lens, glucose is  
 194 metabolized by aldose reductase into sorbitol, which then accumulates within the lens. This results in a  
 195 subsequent osmotic over-hydration of the lens substance. In mild cases, this change may affect the  
 196 refractive index of the lens, which can then lead to fluctuations in refraction related to changes in plasma  
 197 glucose levels. Cortical fluid vacuoles can also develop in these patients, which can evolve into more dense  
 198 opacities [15].

199 Haddad et al [16] reported that cataract extraction in diabetic patients as compared to non-diabetic patients  
 200 is associated with higher risks of reported complications such as capsular contraction and opacification as

201 well as post-surgical worsening of macular edema and diabetic retinopathy. Therefore, the surgeon has to  
202 be vigilant in a cataract operated eye in diabetic patient during postoperative follow up.

203 Eyes of diabetic patients showed more severe corneal endothelial cell damage following cataract surgery  
204 and delayed recovery of corneal edema as described previously [17]. Other anterior segment complications  
205 such as severe iritis, posterior synechiae, pupillary block, and pigmented precipitates on the intraocular  
206 lens are more frequently observed in diabetic patients [18]. Diabetic patients may have increased risk of  
207 postoperative endophthalmitis which may be associated with a poor visual prognosis [19].

208 Significant bleeding is extremely rare during phacoemulsification cataract surgery and even large incision  
209 extracapsular or intracapsular cataract surgery. In a study of 734 hypertensive patients, who had no  
210 perioperative intervention for elevated blood pressure, had no significant difference in surgical complications  
211 compared with normotensives [20]. In a prospective study of 108 cases of suprachoroidal haemorrhage  
212 complicating cataract surgery from 13 centres participating in the United Kingdom British Ophthalmological  
213 Surveillance Unit [21], univariate analysis of potential risk factors found no significant effect of hypertension.  
214 However, good control of hypertension preoperatively as well as postoperatively is important to prevent the  
215 possibilities of post operative bleeding in the eye (hyphema, vitreous haemorrhage, and suprachoroidal  
216 haemorrhage) in a cataract eye.

217 In a population based cohort study, Hu et al [22] reported that the cataract patients undergoing cataract  
218 surgery were associated with a higher risk of ischemic heart disease compared with those cataract patients  
219 without surgery ( $P < 0.05$ ). If asthma is not controlled adequately before the cataract operation, there is  
220 usually cough in these patients. Adequate control of asthma is very important before cataract operation to  
221 avoid the possible postoperative complications such as wound gape, shallow anterior chamber/ iris  
222 prolapse, hyphema and raised intraocular pressure because of persistent cough in these patients.

223

224 The prevalence of ocular comorbidities in the present study (39.8%) is lower than the figures 71.81% [11]  
225 and higher than the other studies reported from different countries (Table 6).

226 **Table 6. Prevalence of coexisting ocular diseases in cataract patients in different countries**

227 Author	228 Place & Country	Total No. of eyes	Ocular comorbidities
229 Arthur et al [5]	Pondichery, India	448	14.73%
230 Shrestha et al [6]	Pokhara, Nepal	675	8.0%
231 Riley et al [7]	Auckland, New Zealand	488	26.0 %
232 Pham et al [8]	Sydney, Australia	653	35.98%
233 Abdelmoaty et al [9]	Kuwait, Kuwait	350	9.7%
234 Thevi & Godinho [10]	Melaka, Malaysia	12992	71.81%
235 Al- Qahtani et al [12]	Riyadh, Saudi Arabia	421	15.43%
236 PRESENT STUDY	Kelantan, Malaysia	324	39.8%

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238

239 The percentage of the common ocular diseases that include open angle glaucoma, diabetic retinopathy and  
 240 age related macular degeneration reported from different countries in cataract patients is shown in Table 7.  
 241

242 **Table 7. Frequency of common ocular diseases in cataract patients in different countries**

243 Author	POAG	DR	ARMD
244 Arthur et al [5]	1.12%	3.35%	---
245 Shrestha et al [6]	1.04%	0.3%	0.3%
246 Riley et al [7]	9.2%	7.6%	5.1%
247 Pham et al [8]	10.6%	9.0%	12.6%
248 Abdelmoaty et al [9]	2.85%%	1.42%	0.57%
249 Thevi & Godinho [10]	6.78%	10.8%	1.55%
250 Al- Qahtani et al [12]	4.6%	5.1%	0.2%
251 PRESENT STUDY	7.1%	9.5%	1.2%

252 POAG= primary open angle glaucoma, DR= diabetic retinopathy, ARMD= age related macular degeneration  
 253

254 The varied prevalence of coexisting ocular diseases could be due to (1) genetic predisposition of the eye  
 255 diseases --- open angle glaucoma, diabetic retinopathy, (2) racial occurrence --- age related macular  
 256 degeneration,, (3) smoking --- age related macular degeneration, (4) associated systemic diseases like  
 257 diabetes, hypertension --- open angle glaucoma, diabetic retinopathy, hypertensive retinopathy, (5) dry and  
 258 dusty weather and environment --- pterygium. The frequency of different diseases depends on the number  
 259 of patients examined in the study.

260 Open angle glaucoma is quite often associated with cataract in the same eye. If the intraocular pressure is  
 261 not controlled adequately before cataract surgery with medications, the eye is at high risk for intraoperative  
 262 vitreous loss/ suprachoroidal haemorrhage during operation. Uncontrolled post operative intraocular  
 263 pressure will lead to glaucomatous cupping and possibility of not achieving good vision in these eyes.  
 264 Earlier, trabeculectomy was performed in the eyes with uncontrolled pressure on glaucoma medications.  
 265 Recently, after control of intraocular pressure with medication, glaucoma triple procedure (cataract  
 266 extraction + IOL implantation + trabeculectomy) is the treatment practiced by many surgeons.

267 Breakdown of the blood-aqueous and blood-retinal barriers may worsen postoperative inflammation after  
 268 cataract surgery in both extracapsular cataract extraction and phacoemulsification, and this vicious cycle  
 269 may instigate or expedite diabetic retinopathy progression [23]. Dowler et al [24] reported that  
 270 uncomplicated phacoemulsification cataract surgery does not accelerate progression of diabetic  
 271 retinopathy as smaller incision size and shorter surgical time in phacoemulsification decrease inflammation  
 272 and may induce less breakdown of the blood-ocular barrier. Similarly, Shah and Chen [25] reported that  
 273 recent studies do not support the generalized conclusion that phacoemulsification causes progression of  
 274 retinopathy and macular oedema in all diabetic patients.

275 The UK diabetic retinopathy electronic medical record users group authors found that the risk of "treatment-  
 276 requiring DME" increased sharply after surgery and peaked in the 3-6 months' period. The risk of macular

277 oedema was associated with preoperative grade of retinopathy; the risk of DME in the 1st year  
278 postoperatively was 1.0% (no diabetic retinopathy preoperatively), 5.4% (mild non proliferative diabetic  
279 retinopathy - NPDR), 10.0% (moderate NPDR), 13.1% (severe NPDR), and 4.9% (proliferative diabetic  
280 retinopathy). This large real-world study proves that the risk of treatment requiring DME increases sharply  
281 in the 1st year after cataract surgery and that those with moderate and severe NPDR are most at risk of  
282 such progression [26].

283 All patients diagnosed with NPDR should undergo detailed retinal examination within 3 months before  
284 cataract extraction. Patients with diabetes, especially those with proliferative retinopathy or those with  
285 inadequate view of the retina before cataract extraction, should be evaluated closely after surgery for  
286 monitoring retinal status [27].

287 Wang et al [28] reported that pooled findings from two large population-based cohorts (Bever Dam and Blue  
288 Mountain Eye studies) support the hypothesis that cataract surgery in older persons without pre-existing  
289 neovascular ARM or gyrate atrophy may be associated with an increased subsequent risk for developing  
290 late-stage ARM, particularly neovascular type. In such patients, the operating surgeon should inform  
291 guarded visual prognosis after cataract surgery.

292 Pterygium (9.8%) was the most common ocular disease seen in cataract patients in the present study. It  
293 causes visual problems due to induced corneal astigmatism (in most of the cases) or direct encroachment  
294 onto the visual axis (in advanced cases). Astigmatism is increased with increase in the size of the  
295 pterygium. Pterygium surgery (bare sclera technique or with additional conjunctival autograft technique) will  
296 improve visual acuity significantly by reducing the astigmatism. Amniotic membrane graft and conjunctival  
297 autograft are better surgical techniques than bare sclera technique in reducing astigmatism is concerned  
298 [29].

300 If the pterygium surgery is done before cataract surgery and the power of intraocular lens (IOL) is calculated  
301 four weeks later (after complete corneal healing), the power of the IOL will be more accurate. Some  
302 surgeons tend to excise the pterygium in one sitting (excision of pterygium done first and then cataract  
303 operation) so that the patient need not come second time for pterygium excision. The combined operation  
304 procedure leads to change in the corneal astigmatism after the cataract surgery which requires optical  
305 correction post operatively to achieve better vision.

306

## 307 **LIMITATIONS**

308 The number of cataract patients in this study is small. This is mainly because only single surgeon (author)  
309 cases are included in this study. Many surgeons and postgraduate trainees in the department shared the  
310 operation theatre time, which was only twice a week. Moreover, there was another government state  
311 hospital to which patients from ministry of health centers and district hospitals were referred for cataract  
312 surgery.

## 313 **CONCLUSION**

314 Ophthalmologists come across systemic diseases and other ocular diseases quite often in cataract patients  
315 in their surgical practice. Comprehensive medical assessment is important to detect the coexisting systemic

316 diseases to prevent preoperative, operative and postoperative complications and mortality in patients  
 317 undergoing cataract surgery. Adequate control of the coexisting ocular diseases is important before  
 318 undertaking cataract surgery to avoid intraoperative and postoperative complications, and to achieve useful  
 319 vision after the operation. In case of advanced stage of the concurrent eye disease present before the  
 320 cataract operation, guarded visual prognosis should be explained to the patient. If the surgeon treats the  
 321 possible post-operative complications in time, the patient's quality of life can be improved.

### 322 Ethical approval

323 This study was approved by ethics committee of School of Medicine, University Sains Malaysia.

### 324 Consent

325 Informed written consent was taken for surgery.

326

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UNDER PEER REVIEW