

Original Research Article

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

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.

The literature search revealed only one report from Ministry of Health Malaysia hospital [10] in which the data of Melaka hospital were taken from the national cataract surgery registry and analyzed for the

40 coexisting systemic and ocular diseases along with many other variables. Therefore, this retrospective
41 study was undertaken to determine the prevalence of coexisting systemic and ocular diseases among the
42 cataract operated patients in a teaching university hospital in north east Malaysia.

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45 **MATERIAL AND METHODS**

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

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

59

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

68

69 The data variables were analyzed by SPSS programme using version 16 software. Categorical variables
70 were presented as frequencies (%). Prevalence rates for systemic diseases were person specific and ocular
71 diseases were eye specific. This study was approved by ethics committee of School of Medicine, University
72 Sains Malaysia.

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74

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 (Table
 80 1).

81

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

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

100 One or more coexisting systemic diseases were present in 113 out of 218 cataract patients (51.8%). The
 101 most common systemic disease was diabetes mellitus (24.3%), followed by hypertension (22.4%), and
 102 ischemic heart disease (4.5%), Table 2.

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

104	Systemic disease	Number	Percentage
105	Diabetes mellitus	53	24.3%
106	Hypertension	49	22.4%
107	Ischemic heart disease	10	4.5%
108	Asthma	8	3.6%
109	Leprosy	3	1.4%
110	Gout	3	1.4%
111	Hemiplegia	3	1.4%
112	Tuberculosis	2	0.9%
113	Hyperthyroidism	2	0.9%
114	Syphilis	1	0.4%
115	Breast carcinoma	1	0.4%

116 Non Hodgkins lymphoma 1 0.4%

117 * some patients had more than one associated systemic disease.

118

119 In addition to cataract, one or more coexisting ocular diseases were present in 129 out of 324 eyes (39.8%).
120 The most common ocular disease was pterygium (11.1%), followed by diabetic retinopathy (8.9%) and open
121 angle glaucoma (7.1%), Table 3.

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.

142

143 DISCUSSION

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

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

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

153	Author	Place & country	Total No.of patients	Systemic comorbidities
154				

155	Arthur et al [5]	Pondichery, India	448	32.81%
156	Shrestha et al [6]	Pokhara, Nepal	675	59.4%
157	Riley et al [7]	Auckland, New Zealand	480	80.0%
158	Pham et al [8]	Sydney, Australia	615	92.52%
159	Abdelmoaty et al [9]	Kuwait, Kuwait	325	61.5%
160	Thevi & Godinho [10]	Melaka, Malaysia	12992	33.79%
161	Ram et al [11]	Chandigarh, India	6103	17.2%
162	Al- Qahtani et al [12]	Riyadh, Saudi Arabia	421	82.66%
163	PRESENT STUDY	Kelantan, Malaysia	218	51.8%%

164

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

168 **Table 5. Prevalence of common systemic diseases in cataract patients in different countries**

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

179

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

191 Haddad et al [16] reported that cataract extraction in diabetic patients as compared to non-diabetic patients
 192 is associated with higher risks of reported complications such as capsular contraction and opacification as
 193 well as post-surgical worsening of macular edema and diabetic retinopathy. Therefore, the surgeon has to
 194 be vigilant in a cataract operated eye in diabetic patient during postoperative follow up.

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

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

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

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

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

218 Author	219 Place & Country	Total No. of eyes	Ocular comorbidities
220 Arthur et al [5]	Pondichery, India	448	14.73%
221 Shrestha et al [6]	Pokhara, Nepal	675	8.0%
222 Riley et al [7]	Auckland, New Zealand	488	26.0 %
223 Pham et al [8]	Sydney, Australia	653	35.98%
224 Abdelmoaty et al [9]	Kuwait, Kuwait	350	9.7%
225 Thevi & Godinho [10]	Melaka, Malaysia	12992	71.81%
226 Al- Qahtani et al [12]	Riyadh, Saudi Arabia	421	15.43%
227 PRESENT STUDY	Kelantan, Malaysia	324	39.8%

228
 229 The percentage of the common ocular diseases that include open angle glaucoma, diabetic retinopathy and
 230 age related macular degeneration reported from different countries in cataract patients is shown in Table 7.
 231

232 **Table 7. Prevalence of common ocular diseases in cataract patients in different countries**

233	Author	POAG	DR	ARMD
234	Arthur et al [5]	1.12%	3.35%	---
235	Shrestha et al [6]	1.04%	0.3%	0.3%
236	Riley et al [7]	9.2%	7.6%	5.1%
237	Pham et al [8]	10.6%	9.0%	12.6%
238	Abdelmoaty et al [9]	2.85%%	1.42%	0.57%
239	Thevi & Godinho [10]	6.78%	10.8%	1.55%
240	Al- Qahtani et al [12]	4.6%	5.1%	0.2%
241	PRESENT STUDY	7.1%	9.5%	1.2%

242 POAG= primary open angle glaucoma, DR= diabetic retinopathy, ARMD= age related macular degeneration
243

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

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

259 The UK diabetic retinopathy electronic medical record users group authors found that the risk of "treatment-
260 requiring DME" increased sharply after surgery and peaked in the 3–6 months' period. The risk of macular
261 oedema was associated with preoperative grade of retinopathy; the risk of DME in the 1st year
262 postoperatively was 1.0% (no diabetic retinopathy preoperatively), 5.4% (mild non proliferative diabetic
263 retinopathy - NPDR), 10.0% (moderate NPDR), 13.1% (severe NPDR), and 4.9% (proliferative diabetic
264 retinopathy). This large real-world study proves that the risk of treatment requiring DME increases sharply
265 in the 1st year after cataract surgery and that those with moderate and severe NPDR are most at risk of
266 such progression [26].

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

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

276 Pterygium (9.8%) was the most common ocular disease seen in cataract patients in the present study. It
277 causes visual problems due to induced corneal astigmatism (in most of the cases) or direct encroachment
278 onto the visual axis (in advanced cases). Astigmatism is increased with increase in the size of the
279 pterygium. Pterygium surgery (bare sclera technique or with additional conjunctival autograft technique) will
280 improve visual acuity significantly by reducing the astigmatism. Amniotic membrane graft and conjunctival
281 autograft are better surgical techniques than bare sclera technique in reducing astigmatism is concerned
282 [29].

283
284 If the pterygium surgery is done before cataract surgery and the power of intraocular lens (IOL) is calculated
285 four weeks later (after complete corneal healing), the power of the IOL will be more accurate. Some
286 surgeons tend to excise the pterygium in one sitting (excision of pterygium done first and then cataract
287 operation) so that the patient need not come second time for pterygium excision. The combined operation
288 procedure leads to change in the corneal astigmatism after the cataract surgery which requires optical
289 correction post operatively to achieve better vision.

291 **LIMITATIONS**

292 The number of cataract patients in this study are much less when compared to three years period. This is
293 mainly because only single surgeon (author) cases are included in this study. Moreover, there were many
294 surgeons and postgraduate trainees who shared the operation theatre which was only twice a week; and
295 there was another government state hospital to which patients from ministry of health centers and district
296 hospitals were referred for cataract surgery .

298 **CONCLUSION**

299 Ophthalmologists come across systemic diseases and other ocular diseases quite often in cataract patients
300 in their surgical practice. Comprehensive medical assessment is important to detect the coexisting systemic
301 diseases to prevent preoperative, operative and postoperative complications and mortality in patients
302 undergoing cataract surgery. Adequate control of the coexisting ocular diseases is important before
303 undertaking cataract surgery to avoid intraoperative and postoperative complications, and to achieve useful
304 vision after the operation. In case of advanced stage of the concurrent eye disease present before the
305 cataract operation, guarded visual prognosis should be explained to the patient. If the surgeon treats the
306 possible post-operative complications in time, the patient's quality of life can be improved.

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309 **REFERENCES**

- 310
- 311 1. WHO. Blindness and vision impairment. [https://www.who.int/news-room/factsheets/detail/blindness-](https://www.who.int/news-room/factsheets/detail/blindness-and-visual-impairment)
- 312 [and-visual-impairment](https://www.who.int/news-room/factsheets/detail/blindness-and-visual-impairment)WHO (accessed on July 19, 2019).
- 313 2. Powe NR, Schein OD, Gieser SC, Tielsch JM, Luthra R, Javitt J, Steinberg EP. Synthesis of the
- 314 literature on visual acuity and complications following cataract extraction and intraocular lens
- 315 implantation. *Cataract Patient Outcome Research Team. Arch Ophthalmol.* 1994;112:239-252.
- 316 3. Prajna NV, Chandrakanth KS, Kim R, Narendran V, Selvakumar S, Rohini G, et al. The Madhurai
- 317 Intraocular Lens Study II: Clinical outcomes. *Am J Ophthalmol.* 1998;125:14-25.
- 318 4. Willerscheidt AB, Healey ML, Ireland M. Cataract surgery outcomes: importance of comorbidities in
- 319 the case mix. *J Cataract Refractive Surg.* 1995;21:177-161.
- 320 5. Arthur DK, Kalaiselvi G. Co morbidities among cataract surgery patients in a tertiary hospital of
- 321 south India. *Indian J Clin Exp Ophthalmol.* 2019;5:58-60.
- 322 6. Shrestha E, Adhikari H, Mahajan IM, Gurung B. Co morbidities among cataract-operated patients in
- 323 rural Nepal. *Nepal J ophthalmol.* 2017;9:156-159.
- 324 7. Riley AF, Malik TY, Grupcheya CN, Fisk MJ, Craig JP, McGhee CN. The Auckland cataract study:
- 325 co-morbidity, surgical technique, and clinical outcomes in a public hospital service. *Br J Ophthalmol.*
- 326 2002;86: 185-190.
- 327 8. Pham TQ, Wang JJ, Rochtchina F, Maloof A, Mitchell P. Systemic and ocular comorbidity of
- 328 cataract surgical patients in a western Sydney public hospital. *Clin exp Ophthalmol.* 2004;32(4):
- 329 383-387.
- 330 9. Abdelmoaty S, Behbehani AM, Aljazzaf A, Grigis N, Eslah E, Marouf T, Almuteri S, Alzafiri Y. The
- 331 Kuwait cataract outcome study: A 12 –month evaluation. *Med Princ Pract.* 2006;15;180-184.
- 332 10. Thevi T, Godinho MA. Predictive factors of visual outcome of Malaysian cataract patients: a
- 333 retrospective study. *Int J Ophthalmol.* 2017;10:1452-1459.
- 334 11. Ram J, Pandav SS, Ram B, Arora FC. Systemic diseases in age related cataract patients. *Int*
- 335 *Ophthalmol.* 1994;18:121-125.
- 336 12. Al- Qahtani B, Ahmad F, Alotaibi M, Al- Zughairi M, Omair A, Al- Jobair K. Cataract surgery
- 337 outcomes in a Tertiary Hospital, Riyadh. *J Health Specialties.* 2016;4:110-115.
- 338 13. Department of statistics Malaysia official website.
- 339 [https://www.dosm.gov.my/v1/index.php?r=column/](https://www.dosm.gov.my/v1/index.php?r=column/cone& menu_id=RU84WGQxYkVPeVpodUZtTkpPdnBmZz09)
- 340 [cone& menu_id=RU84WGQxYkVPeVpodUZtTkpPdnBmZz09](https://www.dosm.gov.my/v1/index.php?r=column/cone& menu_id=RU84WGQxYkVPeVpodUZtTkpPdnBmZz09) (accessed on July 27, 2019).
- 341 14. Hirsch RP, Schwartz B. Increased mortality among elderly patients undergoing cataract extraction.
- 342 *Arch Ophthalmol* 1983;101:1034-1037.
- 343 15. Opto Prep -- Cataracts in systemic diseases. [https://www.optoprep.com/_pps/](https://www.optoprep.com/_pps/FVDLDKXBKKNUTS131675.PDF)
- 344 [FVDLDKXBKKNUTS](https://www.optoprep.com/_pps/FVDLDKXBKKNUTS131675.PDF)
- 345 [131675.PDF](https://www.optoprep.com/_pps/FVDLDKXBKKNUTS131675.PDF) (accessed on August 4, 2019).
- 346 16. Haddad NM, Sun JK, Abujaber S, Schlossman DK, Silva PS. Cataract surgery and its complications
- 347 in diabetic patients. *Semin Ophthalmol.* 2014;29:329-337.
- 348 17. Hugod M, Storr-Paulsen A, Norregaard JC, Nicolini J, Larsen AB, Thulesen J, et al. Corneal
- 349 endothelial cell changes associated with cataract surgery in patients with type 2 diabetes mellitus. *Cornea* 2011;30:749-753.

- 350 18. Krupsky S, Zalish M, Oliver M, Pollack A. Anterior segment complications in diabetic patients
351 following extracapsular cataract extraction and posterior chamber intraocular lens implantation.
352 *Ophthalmic Surg* 1991;22:526-30.
- 353 19. Doft HH. The endophthalmitis vitrectomy study. In: Kertes PI, Conway MD, editors. *Clinical Trials in*
354 *Ophthalmology: A Summary and Practice Guide*. Philadelphia: Lippincott, Williams & Wilkins; 1998.
355 p. 97-111.
- 356 20. Agarwal PK, Mathew M, Viridi M Is there an effect of perioperative blood pressure on intraoperative
357 complications during phacoemulsification surgery under local anaesthesia? *Eye*. 2010;24:1186-
358 1192.
- 359 21. Ling R, Kamalarajah S, Cole M, James C, Shaw S Suprachoroidal haemorrhage complicating
360 cataract surgery in the UK: a case control study of risk factors. *Br J Ophthalmol*. 2004;88:474-477.
- 361 22. Hu WS, Lin CL, Chang SS, Chen MF, Chang KC. Increased risk of ischemic heart disease among
362 subjects with cataracts: A population-based cohort study. *Medicine (Baltimore)*. 2016;95(28):e4119
363 (5 pages).
- 364 23. Liu Y, Luo L, He M, Liu X. Disorders of the blood-aqueous barrier after phacoemulsification in
365 diabetic patients. *Eye (Lond)*. 2004;18:900-904.
- 366 24. Dowler JG, Sehmi KS, Hykin PG, Hamilton AM. The natural history of macular edema after cataract
367 surgery in diabetes. *Ophthalmology* 1999;106:663-668.
- 368 25. Shah AS, Chen SH. Cataract surgery and diabetes. *Curr Opin Ophthalmol* 2010;21:4-9.
- 369 26. Denniston AK, Chakravarthy U, Zhu H, Lee AY, Crabb DP, Tufail A, et al. The UK diabetic retinopathy
370 electronic medical record (UK DR EMR) users group, report 2: Real-world data for the impact of
371 cataract surgery on diabetic macular oedema. *Br J Ophthalmol* 2017;101:1673-1678.
- 372 27. Jaffe GJ, Burton TC, Kuhn E, Prescott A, Hartz A. Progression of nonproliferative diabetic
373 retinopathy and visual outcome after extracapsular cataract extraction and intraocular lens
374 implantation. *Am J Ophthalmol* 1992;114:448-456.
- 375 28. Wang JJ, Klein R, Smith W, Klein BE, Tomany S, Mitchell P. Cataract surgery and the 5-year
376 incidence of late-stage age-related maculopathy: pooled findings from the Bever Dam and Blue
377 MountainEye Studies. *Ophthalmology*. 2003;110:1960-1967.
- 378 29. Garg P, Sahai A, Shamshad MA, Tyagi L, Singhal Y, Gupta S. A comparative study of preoperative
379 and postoperative changes in corneal astigmatism after pterygium excision by different techniques.
380 *Indian J Ophthalmol* 2019;67:1036-1039.
- 381