Original Article

Factors Associated with Complications and Postoperative Visual Outcomes of Cataract Surgery; a Study of 1,632 Cases

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Abstract

Purpose: Cataract surgery is the most common intraocular surgery performed all over the world and has advanced technically in recent years. As in all surgeries, complications are unavoidable. Herein we report factors associated with complications and visual outcomes of cataract surgery.
Methods: This retrospective cohort study included data of 1,632 cataract surgeries performed from 2007 to 2010 which was obtained from the cataract registry of the Malaysian National Eye Database. Demographic features, ocular and systemic comorbidites, grade of surgeon expertise and duration of surgery, type of anesthesia, intraoperative and postoperative complications, and the type of intraocular lens were recorded. Best corrected visual acuities were compared before and after the operation.
Results: Mean patient age was 66.9 years with equal gender distribution. The majority of subjects had age related cataracts. Phacoemulsification was done faster than other surgeries, especially by specialist surgeons. History of prior ocular surgery and operations performed under general anesthesia were associated with greater complications. Phacoemulsification was associated with less complications and better visual outcomes. The age and etiology of cataract did not affect complications. Malays, absence of ocular comorbidities, left eyes and eyes operated under local anesthesia were more likely to experience more visual improvement. Gender, age, cause of cataract, systemic comorbidities and surgeon expertise as well as intra-and postoperative complications did not affect the visual outcomes.
Conclusion: Phacoemulsification had good visual outcomes in cataract surgery. Duration of surgery, expertise of the surgeon and complications did not affect the visual outcomes.

Keywords: Cataract; Extracapsular Cataract Extraction; Phacoemulsification; Posterior Capsule Rupture; Visual Outcome

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INTRODUCTION

Cataract is the leading cause of blindness and cataract extraction is the most common intraocular surgery performed worldwide.[1] Cataract surgery has

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evolved from intracapsular cataract extraction (ICCE) to extracapsular cataract extraction (ECCE) and now to phacoemulsification. The aim of cataract surgery is to provide patients with optimal postoperative vision with no/minimal complications. Intraoperative complications may occur in any surgeon's hands, but appropriate management can result in optimal visual outcome. Due to the small size and double-planed nature of the wound, no suture is required with phacoemulsification. Other advantages of this technique include faster healing and rehabilitation. There is no/very little astigmatism and thus, visual improvement occurs more rapidly allowing the patient to return to work within a few days. However, this procedure requires sophisticated and more expensive equipment. Moreover, the learning curve for converting from standard ECCE to a different type of procedure using the phaco machine is long.

The National Eye Survey of urban and rural populations in different states of Malaysia revealed that cataracts were responsible for 39% of bilateral blindness and 35.9% of low vision.[2] The main objective of this study was to identify factors associated with complications of surgery and visual outcomes among patients who underwent cataract surgery. We also describe patient characteristic, associated ocular and systemic morbidities, experience of the operating surgeon, and various types of procedures performed in patients who underwent cataract surgery at a tertiary hospital in Malaysia.

METHODS

This retrospective cohort study included cataract surgeries performed over a period of 4 years (2007–2010) at Hospital Sultan Haji Ahmad Shah, Temerloh, Pahang, Malaysia. The center is the second government funded specialist hospital (the first one is in state headquarters, Kuantan) providing service to a population of 1,443,365 in 2010, with an average annual population growth rate of 0.5%, and with an ethnic distribution of 74.9% Malays, 16.8% Chinese, 4.0% Indians and 4.3% others.[3] The hospital provides health care services to the people of the district of Temerloh, and is a referral center for Kuala Lipis, Raub, Maran, Bentong, Jerantut and Bera districts of Pahang state. It has general ophthalmology services and subspecialty glaucoma and vitreoretina services by visiting specialists from state headquarters in Kuantan. Data was obtained from the National Eye Database (NED)[4] which is a database of six registries on eye health information, supported by the Malaysian Ministry of Health. The cataract registry was initiated in 2002 and has data pertaining to demographic characteristics, intraoperative and postoperative events, and preoperative as well as postoperative visual acuities. It is used to determine the practice pattern of cataract surgery, and factors influencing the occurrence of complications including posterior capsule rupture, endophthalmitis and postoperative visual outcomes. More importantly, the data is to stimulate research on cataract.

Age, gender and ethnicity of the patients were noted. Furthermore, previous ocular surgery (on the eye to be operated) such as vitreoretinal surgery, penetrating keratoplasty, filtering surgery or pterygium excision were considered. The cause of the cataract, i.e. primary or secondary to trauma or steroids was also noted. Ocular comorbidities such as pterygium involving the cornea, corneal opacity, glaucoma, chronic uveitis, pseudoexfoliation, phacomorphic/phacolytic glaucoma, subluxated/dislocated lens, amblyopia, previous ocular trauma, proliferative/non-proliferative diabetic retinopathy, maculopathy/macular hole/macular scar, optic nerve disease, retinal detachment etc., or whether the fundus could not be assessed due to mature cataract were all recorded. Systemic comorbidities such as systemic hypertension, diabetes mellitus, heart disease, renal failure, cerebrovascular accident and respiratory illness were also recorded. Taking WHO categorization of vision into consideration, best corrected pre-operative visual acuity was divided into good vision (6/6–6/12), impaired vision (6/18–3/60) and poor vision (<3/60).[5]

Experience of the surgeon was also noted. A specialist was considered as a person who has completed the period of gazettement and can work independently without supervision. A gazetting specialist is one who has passed the postgraduate (Master of Surgery in ophthalmology/FRCS) examination and is under the supervision of a full-fledged specialist. The period of gazettement ends once the full-fledged supervising specialist submits a report to the Ministry of Health in Malaysia that the specialist can work independently. A Medical Officer is a MBBS graduate and registered to work by the Malaysian Medical Council, but has not yet passed the postgraduate examination in ophthalmology. The Medical Officer may or may not be a postgraduate student, and performs all core surgical procedures in addition to examining the patients, performing fundus fluorescein angiograms and laser treatment.

The side of the eye operated (right or left), type of cataract surgery (ICCE, ECCE, phacoemulsification or lens aspiration) were considered. The duration of surgery was studied separately with different types of surgery. The duration was divided into less than 20, 21–30, 31–40, 41–50, 51–60, and more than 60 minutes. The type of implanted intraocular lens (IOL) whether posterior chamber IOL (PCIOL) or anterior chamber IOL (ACIOL), foldable or non-foldable, and IOL material (PMMA, acrylic or silicone) were noted and their relationship with development of posterior capsule opacification were studied.

The type of anesthesia (general or local) as well as the type of local anesthesia (retrobulbar, subtenon or

topical) were taken into account. The use of preoperative sedation (oral or intravenous) was also noted. The occurrence of intraoperative complications including posterior capsule rupture (PCR), vitreous loss, zonular dehiscence, dropped nucleus, or suprachoroidal haemorrhage was noted.

Postoperative complications such as corneal edema, endophthalmitis or unplanned return to the operation theater due to iris prolapse, wound dehiscence, raised intraocular pressure, or subluxated intraocular lenses were recorded.

Best corrected visual acuity was tested by hospital optometrists at 12 weeks postoperatively and recorded. This visual acuity was divided into 3 groups similar to preoperative visual acuity. Reasons for not attaining good visual acuity included high astigmatism, posterior capsule opacification (PCO), cystoid macular edema (CME), endophthalmitis, corneal decompensation, intraocular lens decentration/dislocation, retinal detachment or pre-existing ocular comorbidity.

Statistical Analysis

The data were entered into SPSS software16 version (SPSS Inc., Chicago, IL, USA). Numerical data were expressed as mean and standard deviations (SDs). Categorical variables were reported as frequency (n) and percentage (%). Descriptive analysis and univariate analysis were performed. Significance was tested using the Chi-square test and Fisher's Exact test where appropriate. $P < 0.05$ was considered as statistically significant.

RESULTS

A total of 1,964 patients had undergone cataract surgery over a period of 4 years (2007–2010) at Temerloh hospital, Pahang, Malaysia. Patients whose data was incomplete in various sections of the cataract registry of the National Eye Database were not included in the analysis of results. Eventually, data from 1,632 subjects was analyzed for the present study. Demographic data is shown in Table 1. Mean patient age was 64.9 (range, 8–90) years and there were 821 (50.3%) male and 811 (49.7%) female subjects. The majority of patients were Malay (1,076, 65.9%), followed by Chinese (356, 21.8%) and Indian (193, 11.8%). Previous ocular surgery had been performed in 119 (7.3%) subjects, including vitreoretinal surgery in 5, glaucoma filtering surgery in 17, and pterygium excision in 77 cases. Senile or age related cataract (1,560, 95.5%) was the most common form of primary cataracts, followed by congenital and developmental types in 15 and 4 patients, respectively. Traumatic (31 cases) and corticosteroid induced (2 patients) were the secondary types of cataract in the current study.

Ocular comorbidities were present in 320 (19.6%) patients, including the following abnormalities (number of eyes): Pterygia (51), corneal opacity (8), open angle glaucoma (81), phacomorphic glaucoma (5), phacolytic galaucoma (2), chronic anterior uveitis (3), pseudoexfoliation (26), lens subluxation (5), ametropic amblyopia (5), previous eye trauma (3), hypertensive retinopathy (42), proliferative diabetic retinopathy (54), nonproliferative diabetic retinopathy (49), diabetic maculopathy (17), vitreous hemorrhage (2), age related macular degeneration (14), macular hole/scar (6), and retinal detachment (3). In 283 patients, fundus examination could not be performed because of mature cataracts. However, B-scan ultrasonography showed no abnormality in the vitreous or retina in these patients. Systemic comorbidities were present in 1,043 (63.9%) patients including systemic hypertension in 903, diabetes mellitus in 665, ischemic heart disease in 154, renal failure in 35, cerebrovascular accident in 2, and asthma

Table 1. Characteristics of patients undergoing cataract surgery (*n*=1,632)

Variables	*n* (%)
Gender	
Male	821 (50.3)
Female	811 (49.7)
Ethic group	
Malay	1076 (65.9)
Chinese	356 (21.8)
Indian	193 (11.8)
Other	7 (0.4)
Age group	
<40	35 (2.1)
41-50	91 (5.6)
51-60	350 (21.4)
61-70	661 (40.5)
71-80	438 (26.8)
81-90	57 (3.5)
Past ocular surgery	
No	1513 (92.7)
Yes	119 (7.3)
Cause of cataract	
Primary	1599 (98.0)
Secondary	33 (2.0)
Ocular comorbidity	
No	1312 (80.4)
Yes	320 (19.6)
Systemic comorbidity	
No	589 (36.1)
Yes	1043 (63.9)
Operated eye	
Right	834 (51.1)
Left	798 (48.9)
Preoperative vision	
Good	18 (1.1)
Impaired	271 (16.6)
Poor	1343 (82.3)

or chronic obstructive airway disease in 75 cases. Some patients had more than one ocular and/or systemic comorbidities.

Table 2 shows details of cataract surgeries. Most procedures were phacoemulsification (1,011, 61.9%). Specialists performed nearly two thirds (1,067, 65.4%) of cataract surgeries. Most patients were treated as in-patients (1,625, 99.6%). The majority of patients received local anesthesia (1,571, 96.3%), which included sub-tenon in 1,294, peribulbar in 14 and, topical plus intracameral in 263 subjects. All patients received midazolam 7.5 mg orally, one hour before the operation. Mean duration of surgery was 43. 5 (range, 20–75) minutes. Longer operations were performed by medical officers.

Table 2. Details of cataract surgery performed in 1,632 patients

Characteristics	*n* (%)
Type of surgery	
Phacoemulsification	1011 (61.9)
ECCE	520 (31.9)
Phacoemulsification converted to ECCE	63 (3.9)
ICCE	18 (1.1)
Lens aspiration	20 (1.2)
Grade of surgeon	
Specialist	1067 (65.4)
Gazetting specialist	296 (18.1)
Medical officer	269 (16.5)
Type of admission	
Day care	7 (0.4)
In-patient	1625 (99.6)
Operated eye	
Right	834 (51.1)
Left	798 (48.9)
Duration of surgery	
≤30 min	626 (38.4)
31-60 min	815 (49.9)
>60 min	191 (11.7)
Anesthesia	
Local	1571 (96.3)
General	61 (3.7)
Sedation	
Yes	1618 (99.1)
No	14 (0.9)
IOL implanted	
Anterior chamber	58 (3.5)
Posterior chamber in the bag	1537 (94.2)
Posterior chamber in the sulcus	32 (2.0)
Scleral fixated	5 (0.3)
Material of IOL	
Acrylic	992 (60.8)
PMMA	634 (38.8)
Silicone	6 (0.4)

ECCE, extracapsular cataract extraction; ICCE, intracapsular cataract extraction; IOL, intraocular lens; PMMA, polymethyl methacrylate; min, minutes

Factors associated with duration of surgery are detailed in Table 3. Those significantly associated with longer surgical time were type of surgery ($P < 0.001$), experience and grade of surgeon ($P < 0.001$), and the occurrence of intraoperative complications ($P < 0.001$). Phacoemulsification was the fastest method; most cases (579, 54.3%) performed by specialists took less than 30 minutes.

Out of 1,632 patients, intraoperative complications were noted in 171 (21%) subjects. Factors associated with various intraoperative complications are shown in Table 4. Patients with previous ocular surgery ($P = 0.042$) were more likely to develop complications. However, subjects who underwent phacoemulsification (<0.001) were less likely to face intraoperative complications as compared to other types of surgery. Cases operated under general anesthesia also had a higher risk of complications (24, 39.3%). Age of the patient and the cause of cataract did not affect the occurrence of intraoperative complications.

Postoperative complications included endophthalmitis, and reoperations due to iris prolapse, wound dehiscence or subluxated intraocular lens. Absence of ocular surgery prior to cataract operation was associated with a lower frequency of postoperative complications ($P < 0.001$, Table 5).

In our study, 1,233 (75.2%) patients experienced visual improvement after cataract surgery. Preoperative vision was poor (<3/60) in 1,335 (81.8%) while postoperative visual acuity of 6/12 or better was present in 1,077 (66.0%) cases [Figure 1].

Malays were more likely to enjoy visual improvement as compared to other ethnic groups ($P = 0.002$). Patients with no ocular comorbidities ($P < 0.001$), left eyes ($P < 0.001$), and eyes receiving local anesthesia ($P = 0.024$) also had better visual improvement. The type of surgery significantly affected visual improvement ($P < 0.001$); phacoemulsification was associated with the best visual improvement (785 eyes, 77.6%). Acrylic IOL material (769 eyes, 78.2%) was found to entail the best visual outcomes [Table 6].

Gender and age, cause of cataract, systemic comorbidities and the grade of surgeon did not affect visual improvement. Furthermore, intra-and postoperative complications did not affect visual improvement.

DISCUSSION

The current study showed that most (1,011, 61.9%) surgeries were phacoemulsification and performed by specialists (1,067, 65.2%). Currently, phacoemulsification is the ideal method of cataract surgery for most

Table 3. Factors associated with duration of surgery

Variable	≤30 min *n* (%)	31-60 min *n* (%)	>60 min *n* (%)	*P*
Type of surgery				
Phacoemulsification	555 (54.9)	406 (40.2)	50 (4.9)	<0.001
ECCE	55 (10.6)	349 (67.1)	116 (22.3)	
Phacoemulsification converted to ECCE	4 (6.3)	39 (61.9)	20 (31.7)	
ICCE	4 (22.2)	10 (55.5)	4 (22.2)	
Lens aspiration	9 (45.0)	9 (45.0)	2 (10.0)	
Grade of surgeon				
Specialist	579 (54.3)	420 (39.4)	68 (6.4)	<0.001
Gazetting specialist	40 (13.5)	219 (74.0)	37 (12.5)	
Medical officer	7 (2.6)	176 (65.4)	86 (32.0)	
Anesthetic type				
Local	604 (38.4)	780 (49.6)	187 (11.9)	0.339
General	22 (36.1)	35 (57.4)	4 (6.6)	
Type of cataract				
Primary	611 (38.2)	800 (50.0)	192 (11.7)	0.725
Secondary	18 (54.5)	13 (39.4)	2 (6.1)	
Intraoperative complication				
Yes	18 (10.5)	96 (56.1)	57 (33.3)	<0.001
No	608 (41.6)	719 (49.2)	134 (9.2)	

ECCE, extracapsular cataract extraction; ICCE, intracapsular cataract extraction; min, minutes

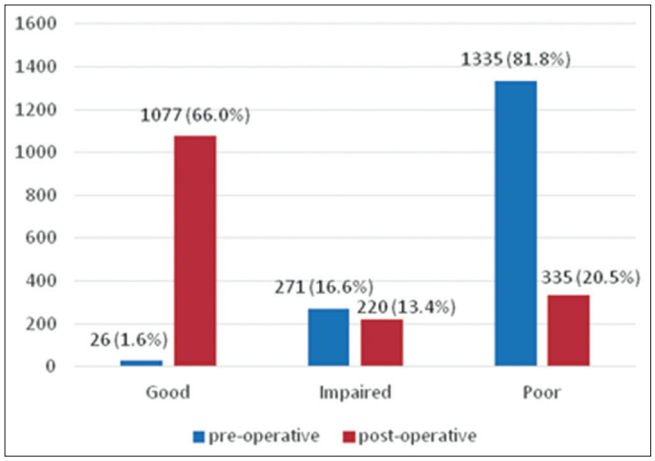

Figure 1. Preoperative and postoperative vision in cataract patients.

surgeons; the wound is small and healing is rapid. In a study conducted in Thailand, visual acuity in patients undergoing different techniques of cataract surgery (phacoemulsification, ECCE and manual phacofragmentation) was compared. Visual acuity after surgery was significantly better than pre-operative levels ($P < 0.05$) and the result persisted for all age groups. Cataract patients operated by phacoemulsification had better postoperative vision than those undergoing ECCE. The majority (1,625, 99.6%) of patients were treated as inpatients and received local anesthesia (1,571, 95.8%).[6]

Due to the increasing number of cataract surgeries and limited beds in hospital wards, it is more convenient to perform day care surgeries. Moreover, the home environment is more conducive for patients and there is less chance of developing hospital acquired infections. The economic advantage of day care surgery has been emphasized in a randomized clinical study,[7] which reported lower costs for outpatient surgery as compare to inpatients. This difference in cost was largely due to the higher cost associated with an overnight stay in hospital. However, most of our patients did not stay close to the hospital, making it difficult to return for removing the dressing and an eye examination on the next day.

Strong et al[8] showed that the rate of preoperative complications was not affected by day care admission, the grade of the operating surgeon, or the type of anesthesia. Koay et al[9] found that pain was significantly less severe in the local anesthesia group as compared to the general anesthesia group. Apart from less pain which may be experienced by the patient, local anesthesia avoids the unnecessary risks of general anesthesia.

The duration of surgery was significantly affected by the type of the operation ($P < 0.001$). Most phacoemulsification procedures (555, 54.9%) were completed within 30 minutes, while most ECCE cases (349, 67.1%) required 31–60 minutes. The majority of cases converted from phacoemulsification to ECCE (39, 61.9%) also took 31–60 min. Most phacoemulsification surgeries used corneal wounds while limbal incisions were used in ECCE for which additional time was spent performing periotomy and cauterization of vessels. The larger wound also takes more time for construction and sealing with sutures. Phacoemulsification wounds often did

Table 4. Factors associated with intraoperative complications

Variable	Complications *n* (%)	No complications *n* (%)	*P*
Gender			
Male	91 (11.1)	730 (88.9)	0.421
Female	80 (9.9)	731 (90.1)	
Ethnic group			
Malay	106 (9.9)	970 (90.1)	0.030
Chinese	43 (12.1)	313 (87.9)	
Indian	19 (9.8)	174 (90.2)	
Other	3 (42.9)	4 (57.1)	
Past ocular surgery			
No	152 (10.0)	1361 (90.0)	0.042
Yes	19 (16.0)	100 (84.0)	
Cause of cataract			
Primary	164 (10.3)	1435 (89.7)	0.081
Secondary	7 (21.2)	26 (78.8)	
Ocular comorbidity			
No	107 (10.2)	945 (89.8)	0.586
Yes	64 (11.0)	516 (89.0)	
Systemic comorbidity			
No	58 (12.2)	418 (87.8)	0.149
Yes	113 (9.8)	1043 (89.5)	
Type of admission			
In-patient	171 (10.5)	1454 (89.5)	0.412
Day care	0 (0)	7 (100)	
Operated eye			
Right eye	87 (10.4)	747 (89.6)	0.950
Left eye	84 (10.5)	714 (89.5)	
Surgery type			
Phacoemulsification	66 (6.5)	945 (93.5)	<0.001
ECCE	56 (10.8)	464 (89.2)	
Phacoemulsification converted to ECCE	35 (55.6)	28 (44.4)	
ICCE	10 (71.4)	4 (28.6)	
Lens aspiration	3 (15.0)	17 (85.0)	
Others	1 (25.0)	3 (75.0)	
Anesthesia			
Local	159 (10.1)	1412 (89.9)	0.017
General	12 (19.7)	49 (80.3)	
Elderly (>70)			
Yes	57 (11.5)	438 (88.5)	0.367
No	114 (10.0)	1023 (90.0)	

ECCE, extracapsular cataract extraction; ICCE, intracapsular cataract extraction

not require sutures. In cases which phacoemulsification was converted to ECCE, the initial corneal wounds were altered, requiring additional time. Moreover, additional time was spent waiting for ECCE instruments to arrive on the table. Minassian et al[10] showed that there was a statistically significant difference between the mean

Table 5. Factors associated with postoperative complications

Variable	Complications *n* (%)	No complications *n* (%)	*P*
Gender			
Male	739 (90.0)	82 (10.0)	1.000
Female	730 (90.0)	81 (10.0)	
Ethnic group			
Malay	969 (90.1)	107 (9.9)	0.619
Chinese	323 (90.7)	33 (9.3)	
Indian	170 (88.1)	23 (11.9)	
Other	7 (100)	0 (0)	
Past ocular surgery			
No	1386 (91.6)	127 (8.4)	<0.001
Yes	83 (69.7)	36 (30.3)	
Cause of cataract			
Primary	1437 (89.9)	162 (10.1)	0.245
Secondary	32 (97.0)	1 (3.0)	
Ocular comorbidity			
No	952 (90.5)	100 (9.5)	0.382
Yes	517 (89.1)	63 (10.9)	
Systemic comorbidity			
No	438 (92.0)	38 (8.0)	0.083
Yes	1031 (89.2)	125 (10.8)	
Type of admission			
In-patient	1462 (90.0)	163 (10.0)	0.123
Day care	79 (100)	0 (0)	
Operated eye			
Right eye	748 (89.7)	86 (10.3)	0.655
Left eye	721 (90.4)	77 (9.6)	
Surgery type			
Phacoemulsification	914 (90.4)	97 (9.6)	0.012
ECCE	471 (90.6)	49 (9.4)	
Phacoemulsification converted to ECCE	48 (76.2)	15 (23.8)	
ICCE	14 (100)	0 (0)	
Lens aspiration	19 (95.0)	1 (5.0)	
Anaesthesia			
Local	1410 (89.8)	161 (10.2)	0.075
General	59 (96.7)	2 (3.3)	
Intraocular lens			
Anterior chamber	48 (92.3)	4 (7.7)	0.061
Posterior chamber IOL	1387 (90.2)	150 (9.8)	
Scleral fixated PCIOL	1 (100)	0 (0)	
Intraocular lens material			
Acrylic	892 (90.7)	92 (9.3)	0.167
PMMA	552 (89.3)	66 (10.7)	
Silicone	2 (50.0)	2 (50.0)	
Elderly (>70)			
Yes	441 (89.1)	54 (10.9)	0.413
No	1028 (90.4)	109 (9.6)	

ECCE, extracapsular cataract extraction; ICCE, intracapsular cataract extraction; IOL, intraocular lens; PCIOL, posterior chamber intraocular lens; PMMA, polymethyl methacrylate

Table 6. Factors associated with visual improvement (*n*=1,632)

Variable	Visual improvement *n* (%)	No improvement *n* (%)	*P*
Gender			
Male	617 (75.2)	204 (24.8)	0.706
Female	616 (76.0)	195 (24.0)	
Ethnic group			
Malay	821 (76.3)	255 (23.7)	0.002
Chinese	264 (74.2)	92 (25.8)	
Indian	147 (76.2)	46 (23.8)	
Other	1 (14.3)	6 (85.7)	
Past ocular surgery			
No	1146 (75.7)	367 (24.3)	0.520
Yes	87 (73.1)	32 (26.9)	
Cause of cataract			
Primary	1212 (75.8)	387 (24.2)	0.108
Secondary	21 (63.6)	12 (36.4)	
Ocular comorbidity			
No	829 (78.8)	223 (21.2)	<0.001
Yes	404 (69.7)	176 (30.3)	
Systemic comorbidity			
No	359 (75.4)	117 (24.6)	0.937
Yes	874 (75.6)	282 (24.4)	
Operated eye			
Right eye	596 (71.5)	238 (28.5)	<0.001
Left eye	637 (79.8)	161 (20.2)	
Surgeon status			
Specialist	796 (74.6)	271 (25.4)	0.187
Gazetting specialist	222 (75.0)	74 (25.0)	
Medical officer	215 (79.9)	54 (20.1)	
Surgery type			
Phacoemulsification	785 (77.6)	226 (22.4)	<0.001
ECCE	386 (74.2)	134 (25.8)	
Phacoemulsification converted to ECCE	44 (69.8)	19 (30.2)	
ICCE	12 (66.7)	6 (33.3)	
Lens aspiration	8 (40.0)	12 (60.0)	
Anesthesia			
Local	1196 (76.1)	375 (23.9)	0.006
General	37 (60.7)	24 (39.3)	
Intraoperative complications			
Yes	125 (73.1)	46 (26.9)	0.430
No	1108 (75.8)	353 (24.2)	
Intraocular lens			
Anterior chamber	37 (71.2)	15 (28.8)	0.097
Posterior chamber	1168 (76.0)	369 (24.0)	
Scleral fixated PCIOL	0 (0)	1 (100)	
Intraocular lens material			
Acrylic	769 (78.2)	215 (21.8)	0.002
PMMA	447 (72.3)	171 (27.7)	
Silicone	3 (75.0)	1 (25.0)	
Postoperative complications			
Yes	129 (79.1)	34 (20.9)	0.261
No	1104 (75.2)	365 (24.8)	

Contd...

Table 6. Contd...

Variable	Visual improvement *n* (%)	No improvement *n* (%)	*P*
Elderly (>70)			
Yes	378 (76.4)	117 (23.6)	0.614
No	855 (75.2)	282 (24.8)	
High astigmatism			
Yes	27 (81.8)	6 (18.2)	0.397
No	1206 (75.4)	393 (24.6)	
Cystoid macular edema			
Yes	3 (60.0)	2 (40.0)	0.601
No	1230 (75.6)	397 (24.4)	
IOL decentration/dislocation			
Yes	0 (0)	1 (100)	0.247
No	1477 (75.3)	484 (24.7)	
Corneal decompensation			
Yes	0 (0)	2 (100)	0.060
No	1233 (75.6)	397 (24.4)	
Posterior capsular opacity			
Yes	2 (50.0)	2 (50.0)	0.252
No	1231 (75.6)	397 (24.4)	

ECCE, extracapsular cataract extraction; ICCE, intracapsular cataract extraction; PCIOL, posterior chamber intraocular lens; PMMA, polymethyl methacrylate; IOL, intraocular lens

duration of surgery in ECCE (27.8 minutes) versus phacoemulsification (20.3 minutes) ($P < 0.001$).

The grade of the surgeon also significantly affected the duration of surgery ($P < 0.001$). Specialists were faster in doing the operations as compared to gazetting specialists and medical officers. Specialists have more experience in performing various types of cataract surgery and are thus faster. Gazetting specialists and medical officers are still learning the procedures or have less experience doing them leading to slower performance.

The occurrence of intraoperative complications affected the duration of surgery. In the case of phacoemulsification converted to ECCE, time would be spent for setting up the necessary instruments, fluid used for irrigation and aspiration was changed to adrenaline-free (if the posterior capsule was ruptured), and additional time was spent addressing possible complications.

The type of anesthesia used did not affect the duration of surgery. The etiology of cataract whether primary (senile or congenital) or secondary (traumatic or steroid induced) also did not affect the duration of the procedure. No study could be found in the literature correlating the duration of cataract surgery with the type of anesthesia or etiology of cataract.

Out of 1,632 patients, 171 (21.0%) subjects experienced intraoperative complications. Factors found to be significantly associated with intraoperative complications included previous ocular surgery such as pterygium excision, penetrating keratoplasty, filtering surgery or vitreoretinal surgery ($P = 0.042$). This may have been an incidental finding. The occurrence of complications associated with previous ocular surgery could not be found in any other published studies.

The other factor which was significantly associated with complications was the type of surgery. In the present study, phacoemulsification was associated with the lowest rate of complications (6.5%) while phacoemulsification converted to ECCE and ICCE was associated with a higher rate of complications (55.0 and 71.4%, respectively). Complications included posterior capsule rupture (PCR), vitreous loss, zonular dehiscence, dropped nucleus, suprachoroidal hemorrhage, and central corneal edema. Phacoemulsification cases were done by surgeons who were competent in ECCE and hence had more experience in ocular surgery. In a study by Ti et al, PCR rates by faculty members were lower than residents ($P < 0.01$).[11] Subjects with dense cataracts, corneal scars involving or encroaching the visual axis, pseudoexfoliation, poor pupillary dilatation and lenses which were subluxated or had phacodonesis were not scheduled for phacoemulsification. The lower incidence of complications could be attributed to exclusion of these factors.

Phacoemulsification was converted to ECCE if a problem arose during attempted phacoemulsification. Fairly often, the reason for conversion to ECCE was a continuous curvilinear capsulorhexis which was incorrectly done or difficulty in sculpting the nucleus. Other causes for conversion included recognition of problems such as a subluxated lens, difficulty in rotating the nucleus, pupil constriction or recognition of a PCR.

Observed complications included posterior capsule rupture, vitreous loss, zonular dehiscence, dropped

nucleus, suprachoroidal hemorrhage and central corneal edema. In the study by Johnston et al, data were extracted on 55,567 cataract operations performed at 12 NHS trusts by 406 surgeons between November 2001 and July 2006. PCR rates were highest for the most junior grade of surgeons and those contributing relatively few cases to the data set. PCR rate was lowest among experienced surgeons contributing large numbers of cases to the data set.[12]

In a comparison study of various complications of cataract surgery, PCR occurred in 1.5–3.1%, vitreous loss in 0.8–1.39%, dropped nuclear material in 0.18-1%, and suprachoroidal hemorrhage in 0.07–0.14% of cases.[13] In our study, the rate of combined complications was high. This could be contributed to the variable experience of operating surgeons as some trainees were learning cataract surgery.

Castells et al[14] also found that patients undergoing phacoemulsification developed a lower frequency of intraoperative complications as compared to ECCE, specifically for intraoperative iris trauma ($P = 0.004$). The Iranian Cataract Surgery Survey 2000–2005 also found that the risk of intraoperative complications was lowest in phacoemulsification (2.29%) and highest in ICCE (36.17%).[15] Type of anesthesia was associated with intraoperative complications. Local anesthesia was associated with less intraoperative complications (10.1%) as compared to general anesthesia (19.7%). This could be explained by the fact that cataract surgeries which were anticipated to be challenging due to small pupil, pseudoexfoliation or uncooperative patients were scheduled under general anesthesia.

Patient age and gender, etiology of cataract, ocular and systemic comorbidities, the side of operated eye, type of admission and type of anesthesia did not affect the occurrence of intraoperative complications. Zare et al[16] found that ocular comorbidities such as pseudoexfoliation and high myopia were significantly associated with vitreous loss. Chen et al[17] also found that miosis, shallow anterior chamber, pseudoexfoliation, floppy iris syndrome, and zonulopathy were the main causes of vitreous loss. In a study of cataract surgeries among different races in Singapore, it was found that racial differences did not affect the occurrence of PCR.[18]

Patients with no ocular surgery prior to cataract surgery had a lower chance of postoperative complications ($P < 0.001$). The etiology of the cataract, the type of admission for surgery and presence of systemic comorbidities did not have a bearing on postoperative complications. In a study comparing 50 patients with diabetes and 50 patients without diabetes undergoing cataract surgery, Ivancic et al[19] found that the most common postoperative complications in diabetic patients were inflammatory reactions and bleeding, postoperative keratopathy, anterior uveitis with posterior synechiae, and opacification of the posterior capsule.

We observed a higher rate of postoperative complications with phacoemulsification procedures converted to ECCE ($P = 0.012$). The type and material of the IOL did not affect postoperative complications.

In a study from rural Africa, there was no difference in the incidence of complications and procedures between anterior chamber and posterior chamber intraocular lenses.[20] Walkow et al,[21] found that 37 patients required IOL exchange due to decentration or subluxated PCIOL. Gaton et al[22] reported a series of 6 subjects (7 eyes) treated for pupillary block after PCIOL implantation.

A total of 1,233 patients (70.6%) showed visual improvement after surgery. Patients without ocular comorbidities had a better outcome. In a study on 181 cases by Naeem et al,[23] patients who had ocular comorbidities such as diabetic retinopathy, glaucoma and ocular trauma did not attain good visual acuity. However, in a study in rural China, Liu et al[24] reported that visual function ($P = 0.197$) and satisfaction with surgery ($P = 0.796$) were not related with ocular comorbidities. In an analysis of data from the European Registry of Quality Outcomes for Cataract and Refractive Surgery, ocular comorbidity and postoperative complications had the strongest influence on visual outcomes.[25]

In our series, left eyes had a better visual outcome. During the operation, surgeons often sat at the head of the patient and not temporally. Therefore incisions were made superotemporally in right eyes and superonasally in left eyes. Altan-Yaycioglu et al[26] compared superotemporal incisions in the right eye to superonasal incisions in the left eye and showed that superotemporal incisions yielded less against-the-rule and surgically induced astigmatism as compared to superonasal incisions ($P < 0.001$). In left eye surgeries, the surgeons sometimes sat temporally to avoid obstruction by the nose which eliminated against-the-rule astigmatism.

Patients who underwent surgery under local anesthesia had a better outcome as compared to those operated under general anesthesia ($P = 0.05$). Patients were usually operated under local anesthesia. General anesthesia was used if the patient was anticipated to be uncooperative for local anesthesia, was hard of hearing, had comorbidities such as tremors, was aged less than 20 years, or if he/she requested it.

Type of surgery affected the visual outcome ($P < 0.001$) and it was found that phacoemulsification had the best outcome. In a study on 11 trials involving 1,228 participants, it was found that subjects in the phacoemulsification group were also more likely to achieve BCVA of 6/12 or more at 3 months (four studies with 645 participants) and at 1 year (one study with 439 cases), but the difference between the two groups was smaller.[27]

In a study on secondary IOL implantation for aphakia, it was found that a final corrected distance visual acuity of

20/40 or better was achieved in 22 (62.9%) eyes implanted with an anterior chamber iris fixated IOL, 12 (50%) eyes with a retropupillary iris-fixated IOL, and 18 (58.1%) eyes with a scleral-fixated PCIOL.[28] In a prospective randomized clinical trial on 996 patients followed for one year, it was found that 90.3% of patients who had foldable hydrophilic acrylic IOLs and 94.3% of patients with PMMA IOLs had uncorrected visual acuity of 6/18 or better.[29]

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Conflicts of Interest

There are no conflicts of interest.

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