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Intraoperative Complications during Phacoemulsification in Cataract Surgery at a Tertiary Care Hospital

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Abstract

Background: Intraoperative and postoperative complications do occur in phacoemulsification technique especially with inexperienced individuals. Being a tertiary care centre, we perform a number of phacoemulsification surgeries every year. **Aims and Objectives:** The present study was planned to assess the intraoperative complications during phacoemulsification in cataract surgery and determine the visual outcomes after phacoemulsification for cataract. **Material and Methods:** It was a prospective observational study involving patients undergoing cataract surgery, conducted at Department of Ophthalmology, at Dr. Vasantrao Pawar Medical College, Hospital and Research Centre, Nashik, Maharashtra. The study was conducted over two years between August 2018 to November 2020 among 186 eyes. **Results:** Rate of intraoperative complication in our study was 9.1%. Among the complications, difficulty in nucleus emulsification (5.4%) was most common followed by posterior capsular rent (2.2%), CCC-related complication (1.6%). Iris prolapse occurred in 1.1% whereas detachment of Descemet's membrane, vitreous loss and nucleus drop were noted in one (0.5%) patient each. **Conclusions:** In our study, rates of intraoperative complication was 9.1% that is comparable to previous reports. Difficulty in nucleus emulsification was most complication.

Keywords: Cataract, Intraoperative Complications, Phacoemulsification

1. Introduction

World Health Organization (WHO) estimates that globally nearly 2.2 billion people have a vision impairment or blindness. Among them, nearly half of vision impairment is preventable. Cataracts and Uncorrected refractive errors are the leading etiology of vision loss[1]. Cataract is responsible for 33.4% of all blindness and 18.4% of moderate to severe vision impairment[2]. In India, it is estimated that cataract causes blindness in nearly 3.8 million people each year[3]. A recent meta-analysis identifies that age standardized prevalence of cataract is 17.20% with most individuals with cataract being greater than 60 years of age[4]. In subtypes of cataract, the estimated prevalence is 8.05%, 8.22% and 2.24% for the cortical cataract, nuclear cataract and Posterior Subcapsular (PSC) cataract respectively[4].

The India Study of Age-related Eye (INDEYE study) disease reported cataract prevalence of 58% and 53% in North and South India respectively in people aged ≥60 years. Among subtypes, nuclear cataract was the most frequent type (48% and 38%) followed by PSC (21% and 17%) and cortical cataract (7.6% and 10.2%)[5]. Etiopathologically, besides age, genetic factors, nutrition, diabetes mellitus, trace metals, ultraviolet radiation, smoking, alcohol intake, age-related macular degeneration, lower socioeconomic status etc. are common risk factors for causation of cataracts[6,7].

American Academy of Ophthalmology identifies that symptomatic cataract is a surgical illness and surgery is the most accurate therapy. A small-incision phacoemulsification with foldable Intraocular Lens (IOL) implantation is the recommended standard of care in cataract surgery[8]. The cataract surgery has progressed from

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couching, Extracapsular Cataract Extraction (ECCE) to intracapsular extraction and phacoemulsification.

Phacoemulsification was familiarized in 1967 by Charles Kelman, an American Ophthalmologist, as an alternative to the conventional ECCE[9]. The advantages of the phacoemulsification procedure include small incision, minimal to no blood loss, good initial visual recovery postoperatively, with lesser rates of astigmatism[10].

In experienced hands, the surgical procedure is very safe with minimal complications. However, no surgical technique is free of complications. Ravinder *et al*., from India reported 17% of patients with intraoperative complications of phacoemulsification. The most common complication was difficulty in emulsifying an unexpectedly hard nucleus with conversion to minor incision cataract surgery in 4% cases followed by posterior capsule rupture (3%), iris incarceration in to phaco probe (3%) and 2% each of running rhexis with incomplete continuous curvilinear capsulorhexis and tunnel related or premature entry[10].

Researches indicate, intraoperative and postoperative complications do occur in phacoemulsification technique especially with inexperienced individuals. Being a tertiary care centre, we perform a number of phacoemulsification surgeries every year. However, the institutional rates of complication during such surgery have not been prospectively studied. At the same time, there is general lack of studies from Western region of India assessing the complications of phacoemulsification. Therefore, we planned this study to assess the intraoperative complications while phacoemulsification in cataract surgery and determine the visual outcomes after phacoemulsification for cataract.

2. Aims and Objectives

1. To assess the intraoperative complications during phacoemulsification in cataract surgery
2. To determine the visual outcomes after phacoemulsification for cataract.

3. Material and Methods

The study is prospective observational study involving patients undergoing cataract surgery, conducted at Department of Ophthalmology, at Dr. Vasantrao Pawar Medical College, Hospital and Research Centre, Nashik, Maharashtra. The study was conducted over a period of two years between August 2018 to November 2020 among 186 eyes, to study the intraoperative complications and visual outcome after phacoemulsification.

3.1 Inclusion Criteria

Age more than 40 years irrespective of gender, patients undergoing phacoemulsification cataract surgery with intraocular lens implantation and grade I, II and III cataracts were included in the present study.

3.2 Exclusion Criteria

Patients with history of long term local or systemic steroid use as this would affect wound healing, Patients with corneal abnormalities such as dystrophies and degenerations where reliable keratometry is not possible and patients with ocular posterior segment pathology, that is hypertensive and diabetic retinopathy were excluded from the present study.

3.3 Methodology

The study was conducted on 186 eyes of patients presenting to the outpatient department of a tertiary care center with cataract. The patients were evaluated and those found to have cataract within the inclusion criteria were selected for the study. A detailed history was obtained from each patient followed by a complete ocular examination.

3.3.1 Pre-operative Examination

Best corrected visual acuity, Intraocular tension by Goldmann's applanation Tonometer, Slit lamp evaluation for Anterior Segment evaluation and type and Grading of cataract according to LOCS-III, Fundus examination by 78 D and Indirect ophthalmoscope to rule out any posterior segment pathology and A scan, Keratometry for IOL power calculation and Lacrimal Sac Syringing.

Patients were subjected for blood investigations like CBC, Blood Sugar Fasting and Postprandial, Urine routine and microscopy HIV and HBsAg. Any significant past, family history, drug history was noted. The patients were advised to instill antibiotic drops one day before surgery.

A tablet of Acetazolamide 250 mg was given a night prior to surgery and one in the morning on the day of surgery. Xylocaine sensitivity test was done a day prior to surgery. On the day of surgery, the eye to be operated

upon was dilated with eye drops containing tropicamide (0.8%), phenylephrine (5%), one drop every 10-15 minutes starting one hour before surgery till full dilatation. One drop of Flurbiprofen (0.03%) was also be instilled after full dilatation to prevent intraoperative miosis.

3.2.2 Intraoperative Procedure

All surgeries were done under peribulbar anaesthesia. 2% Lignocaine was the local anaesthetic in combination with adrenaline 1:1000 along with Hyaluronidase to facilitate diffusion of the anaesthetic solution. About 5 ml of local anaesthetic was injected. Digital massage was given.

After taking all aseptic precautions, eyelids were cleaned with povidone iodine 5% and draped. Wire speculum was placed, superior rectus bridle suture was passed and clamped on to the towel. Surgeries were done under Carl Zeiss Meditec AG operating Microscope. The phacoemulsification machine was OPTIKON 2000 S.p.A. minimal stress. This machine has a peristaltic type of pump.

After a good peribulbar block, a 2.8 mm wide clear corneal incision was made with crescent blade. Side port incision was made in clear cornea at 9 O'clock position using a lance tip blade. Viscoelastic was put to maintain the anterior chamber. Capsulorrhexis was performed using a cystitome made by a bent 26G needle. In patients with poor red fundal reflex, trypan blue enhanced capsulorrhexis was done. The rhexis was approximately 5.5 to 6 mm in diameter. After hydrodissection and hydrodelineation, rotation of the nucleus within the bag was confirmed. The second side port incision was made using a lance tip blade at 2 O'clock position.

The technique of phacoemulsification used was stop and chop technique. Phacoemulsification machine tip was used to impale and emulsify the nucleus. The procedure was repeated until all quadrants were emulsified. Parameters for phacoemulsification, epinucleus removal and bimanual irrigation and aspiration were noted. Total Phacoemulsification time was recorded.

A foldable intraocular lens was inserted. Intra operative complications that may have occurred during the procedure were noted. In cases of intraoperative complications such as posterior capsule rent, anterior vitrectomy was done and a three-piece intraocular lens was implanted. Other complications were noted and were managed appropriately.

At the end of the procedure the anterior chamber was formed using ringer lactate and both the side ports hydrated. Sub-conjunctival injection of gentamicin and dexamethasone were given and the eye was bandaged. Post- operative instillation of topical antibiotic steroid combination (prednisolone acetate 1% along with moxifloxacin 0.5%) was advised. Patients were examined on first postoperative day and discharged. They were advised regular follow-up at one week, 1st month and 3rd month following surgery and refraction was assessed. Postoperative refraction was given on 1 month follow up. All data was recorded in the structured proforma.

3.4 Statistical analysis

Data from the case proforma was entered in to Microsoft excel 2016 (Microsoft Corporation, USA) and was analyzed with the same. Continuous variables were presented as mean and standard deviation. Categorical variables were presented as frequency and percentages.

4. Results

Mean age of the patients was 58.7 ± 9.7 years. Majority of the patients belonged to age group of 51 to 60 years (38.2%) followed by 61 to 70 years (26.9%). In the age group of ≤50 years and ≥71 years, there were 22.6% and 12.4% of patients, respectively. Proportion of males was 45.2% and that of females 54.8%. The male to female ratio was 0.82:1. Right eye was involved in 97 (52.2%) patients whereas left eye was involved in 89 (47.8%) patients (Table 1).

Table 1. Demographic parameters and presentation

Demographic parameters and presentation		Frequency	Percentage
Age distribution	≤50	42	22.6
	51 to 60	71	38.2
	61 to 70	50	26.9
	≥71	23	12.4
Genderwise distribution	Male	84	45.2
	Female	102	54.8
Laterality	Right	97	52.2
	Left	89	47.8

Nuclear cataract (90.3%) was most frequently observed followed by posterior subcapsular cataract (44.1%), cortical cataract (39.8%) and posterior polar

cataract (10.8%). Among patients with nuclear cataract, proportion of patients with cataract grade NS-1, NS-2 and NS-3 was 34.4%, 44.6% and 11.3%, respectively. Any single type of cataract was seen in 37.1% of the patients whereas two and three types of cataract were seen in 48.4% and 14.5% of patients, respectively (Table 2).

4.1 Intraoperative Complications Observed during the phacoemulsification Procedure

Rate of intraoperative complication in our study was 9.1%. Among the complications, difficulty in nucleus emulsification (5.4%) was most common followed by posterior capsular rent (2.2%), Continuous Cuvrilinear Capsulorrhexis (CCC) related complication (1.6%). Iris prolapse occurred in 1.1% whereas detachment of Descemet's membrane, vitreous loss and nucleus drop were noted in one (0.5%) patient each (Figure 1).

Table 2. Cataract type

Cataract type		Frequency	Percentage
Nuclear cataract	NS-1	64	34.4
	NS-2	83	44.6
	NS-3	21	11.3
Cortical cataract		74	39.8
Posterior subcapsular cataract		82	44.1
Posterior polar cataract		20	10.8
Combined type cataract	1	69	37.1
	2	90	48.4
	3	27	14.5

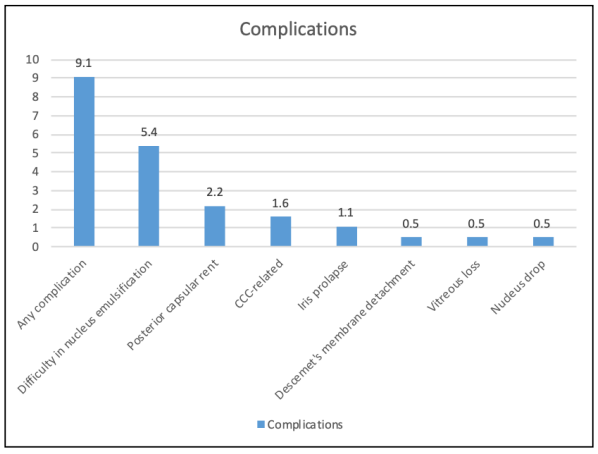

Figure 1. Intraoperative complications.

Mean phacoemulsification time was 1.1±0.4 min. In majority of patients, phacoemulsification time was <1 min (48.4%) followed by 1 to 1.5 min (37.1%), 1.6 to 2 min (11.8%), and >2 min (2.7%) (Table 3).

4.2 Changes in Vision in Postoperative Period

On day 1 postoperatively, vision of 6/6 was seen in 53.2% of patients. The proportion of patients with vision 6/6 gradually increased to 56% on day 7, 65.6% on day 30 and to 77.5% of patients. Similarly, vision of 6/9 was observed in 24.7% of patients on day 1. On day 7, 30 and 90, 6/9 vision was seen in 32.8%, 31.7% and 22% of patients, respectively. Proportion of patients with vision of 6/12 decreased gradually from 13% on day to 7.5% on day 7 and 2.2% on day 30. Patients with 6/18 vision decreased from 5.9% on day 1 to 2.7% on day 7. Only one patient had 6/18 vision at day 90. Vision of 6/18 was seen in 2.7% of patients on day 1 and 0.5% on day 7. One patient with vision 6/36 was seen on day 1, day 7, day 30 but not on day 90 (Table 4).

Table 3. Operative parameters

Operative parameters		Frequency	Percentage
Phacoemulsification time (min)	<1	90	48.4
	1 to 1.5	69	37.1
	1.6 to 2	22	11.8
	>2	5	2.7
	Mean ± SD	1.1±0.4	
Conversion to SICS	Yes	4	2.2
	No	182	97.8

Table 4. Vision changes in postoperative period

Visual acuity	Day 1	Day 7	Day 30	Day 90
6/6	99 (53.2)	104 (56.0)	122 (65.6)	144 (77.5)
6/9	46 (24.7)	61 (32.8)	59 (31.7)	41 (22.0)
6/12	24 (13.0)	14 (7.5)	4 (2.2)	0
6/18	11 (5.9)	5 (2.7)	0	1 (0.5)
6/24	5 (2.7)	1 (0.5)	0	0
6/36	1 (0.5)	1 (0.5)	1 (0.5)	0

4.3 Vision Changes According to the Intraoperative Complications

In patients with difficulty in nucleus emulsification (n = 10), patients with 6/6 vision increased from 10% at day 1 to 20% at day 7, 40% at day 30 and 60% at day 90. Patients with 6/9 vision increased from 10% to 20% at day 7, 30% at day 30 and 30% at day 90. Patients with 6/12 vision were 20% at day 1, 10% at day 7 and 20% at day 30. Patients with 6/18 vision were 20% at day 1, 30% at day 7 and 10% at day 90. Patients with 6/24 vision were 30% at day 1, and 10% at day 7. One patient (10%) had vision of 6/36 at day 1, day 7 and day 30.

In patients with posterior capsular rent (n = 4), one patient (25%) each had vision of 6/9, 6/12, 6/18 and 6/24 at day 1 which changed to 1 (25%), 2 (50%) and 1 (25%) patient with 6/9, 6/12 and 6/18 vision at day 7. At day 30 and 90, one patient (25%) had vision 6/6 whereas remaining 3 (75%) had vision 6/9.

In patients with CCC-related complications (n = 3), one patient each had vision 6/9, 6/18 and 6/24 at day 1. On day 7, vision was 6/9, 6/12 and 6/18 in one patient each. On day 30 and 90, all patients had vision 6/9.

In patients with iris prolapse (n = 2), vision was 6/6 and 6/18 on day 1 an day 7 in one patient each which changed to 6/6 and 6/9 on day 30 and to 6/6 in both patients at day 90. In a patient with Descemet's membrane detachment, vision at day 1, 7, 30 and 90 was 6/18, 6/12, 6/9 and 6/6, respectively.

In a patient with vitreous loss, vision at day 1, 7, 30 and 90 was 6/18, 6/12, 6/9 and 6/9, respectively. In a patient with nucleus drop, vision at day 1, 7, 30 and 90 was 6/18, 6/18, 6/9 and 6/6, respectively.

Table 5. Vision changes in different complications

Vision	Complications						
	Difficulty in nucleus emulsification (n=10)	**Posterior capsular rent (n=4)**	**CCC-related (n=3)**	**Descemet's membrane detachment (n=1)**	**Iris prolapse (n=2)**	**Vitreous loss (n=1)**	**Nucleus drop (n=1)**
Day 1							
6/6	1 (10.0)	0	0	0	1 (50.0)	0	0
6/9	1 (10.0)	1 (25.0)	1 (33.3)	0	0	0	0
6/12	2 (20.0)	1 (25.0)	0	0	0	0	0
6/18	2 (20.0)	1 (25.0)	1 (33.3)	1 (100.0)	1 (50.0)	1 (100.0)	1 (100.0)
6/24	3 (30.0)	1 (25.0)	1 (33.3)	0	0	0	0
6/36	1 (10.0)	0	0	0	0	0	0
Day 7							
6/6	2 (20.0)	0	0	0	1 (50.0)	0	0
6/9	2 (20.0)	1 (25.0)	1 (33.3)	0	0	0	0
6/12	1 (10.0)	2 (50.0)	1 (33.3)	1 (100.0)	1 (50.0)	1 (100.0)	0
6/18	3 (30.0)	1 (25.0)	1 (33.3)	0	0	0	1 (100.0)
6/24	1 (10.0)	0	0	0	0	0	0
6/36	1 (10.0)	0	0	0	0	0	0
Day 30							
6/6	4 (40.0)	1 (25.0)	0	0	1 (50.0)	0	0
6/9	3 (30.0)	3 (75.0)	3 (100.0)	1 (100.0)	1 (50.0)	1 (100.0)	1 (100.0)
6/12	2 (20.0)	0	0	0	0	0	0
6/36	1 (10.0)	0	0	0	0	0	0
Day 90							
6/6	6 (60.0)	1 (25.0)	0	1 (100.0)	2 (100.0)	0	1 (100.0)
6/9	3 (30.0)	3 (75.0)	3 (100.0)	0	0	1 (100.0)	0
6/18	1 (10.0)	0	0	0	0	0	0

4.4 The Association of Phacoemulsification Time with Vision Changes in Postoperative Period

In patients with phaco time of <1 min (n = 90), vision of 6/6 was seen in 62.2% of patients at day 1, 62.2% of patients at day 7, 70% at day 30 and 81.1% of patients at day 90. There were 25.6% of patients with 6/9 vision on day 1 which changed to 34.4% on day 7, 30% on day 30 and 18.9% on day 90. Vision of 6/12 was noted in 12.2% of patients at day 1 and in 3.3% of patients at day 7.

In patients with phaco time of 1 to 1.5 min (n = 69), vision of 6/6 was seen in 47.8% of patients at day 1, 56.5% of patients at day 7, 69.6% at day 30 and 78.3% of patients at day 90. There were 26.1% of patients with 6/9 vision on day 1 which changed to 36.2% on day 7, 30.4% on day 30 and 21.7% on day 90. Vision of 6/12 was noted in 18.8% of patients at day 1 which changed to 7.2% of patients at day 7. 5.8% and 1.4% of patients had vision of 6/18 and 6/24 on day 1 only (Table 5).

In patients with phaco time of 1.6 to 2 min (n=22), vision of 6/6 was seen in 36.4% of patients at day 1, 31.8% of patients at day 7, 40.9% at day 30 and 68.2% of patients at day 90. There were 22.7% of patients with 6/9 vision on day 1 and on day 7 which changed to 45.5% on day 30 and 27.3% on day 90. Vision of 6/12 was noted in 22.7% of patients at day 7 which changed to 9.1% of patients at day 7. 27.3% of patients had 6/18 vision on day 1 which changed to 18.2% at day 7 and 4.5% at day 90.On day 1, 9.1% of patients had vision 6/24 and 4.5% had vision of 6/36. This one patient had vision of 6/36 on day 7 and day 30 but not on day 90.

In patients with phaco time of > 2 min (n = 5), vision of 6/6 was seen in 40% of patients at day 1, 7, 30, and 90. Vision of 6/9 was noted in one patient (20%) at day 30 and in three patients (60%) at day 90. One patient (20%) had vision of 6/18 on day 1, and day 7. One patient (20%) had vision 6/12 on day 7 which changed to two (40%) at day 30. Two (40%) had 6/24 vision on day 1 that changed to 20% on day 7 (Table 6).

Table 6. Association of phaco time with vision

Vision	Phaco time (min)			
	<1 (n = 90)	1 to 1.5 (n = 69)	1.6 to 2 (n = 22)	>2 (n = 5)
Day 1				
6/6	56 (62.2)	33 (47.8)	8 (36.4)	2 (40.0)
6/9	23 (25.6)	18 (26.1)	5 (22.7)	0
6/12	11 (12.2)	13 (18.8)	0	0
6/18	0	4 (5.8)	6 (27.3)	1 (20.0)
6/24	0	1 (1.4)	2 (9.1)	2 (40.0)
6/36	0	0	1 (4.5)	0
Day 7				
6/6	56 (62.2)	39 (56.5)	7 (31.8)	2 (40.0)
6/9	31 (34.4)	25 (36.2)	5 (22.7)	0
6/12	3 (3.3)	5 (7.2)	5 (22.7)	1 (20.0)
6/18	0	0	4 (18.2)	1 (20.0)
6/24	0	0	0	1 (20.0)
6/36	0	0	1 (4.5)	0
Day 30				
6/6	63 (70.0)	48 (69.6)	9 (40.9)	2 (40.0)
6/9	27 (30.0)	21 (30.4)	10 (45.5)	1 (20.0)
6/12	0	0	2 (9.1)	2 (40.0)
6/36	0	0	1 (4.5)	0
Day 90				
6/6	73 (81.1)	54 (78.3)	15 (68.2)	2 (40.0)
6/9	17 (18.9)	15 (21.7)	6 (27.3)	3 (60.0)
6/18	0	0	1 (4.5)	0

5. Discussion

Phacoemulsification (PE) is the cataract extraction procedure used worldwide for almost every cataract extraction. PE reduces the complication of wound healing related to large incision cataract surgery and shortens the postoperative care. We here discuss the results of our study in relation to the relevant literature studies.

Mean of the patients was 58.7 ± 9.7 years. Majority of the patients belonged to age group of 51 to 60 years (38.2%) followed by 61 to 70 years (26.9%). A study from Ng *et al.*[11] reported mean age of 74.0 ± 9.0 years in a sample of 1000 cases of PE. A study from Ravinder *et al.*[10] observed mean age of patients with cataract to be 57.73 years. Among 100 patients, majority were in age group pf 51 to 60 years (30%) followed by 61 to 70 years (26%). These results are similar to our study. It indicates cataract is more frequent in the group of people above 50 years of age.

In our study, proportion of males was 45.2% and that of females 54.8%. In their study, In a study from Ng *et al.*,[11] proportion of males and females was 65.2% and 34.8%, respectively which is in contrast with our observations.

In our study patients, right eye was involved in 97 (52.2%) patients whereas left eye was involved in 89 (47.8%) patients. Study from Ng *et al.*[11] observed right and left eye involvement in 51.5% and 48.5% of cataract patients, respectively. Ravinder *et al.*[10] reported right and left eye involvement in 45% and 55% of the patients.

5.1 Type of Cataract

In our study, nuclear cataract (90.3%) was most frequently observed followed by posterior subcapsular cataract (44.1%), cortical cataract (39.8%), and posterior polar cataract (10.8%). Among patients with nuclear cataract, proportion of patients with cataract grade NS-1, NS-2 and NS-2 was 34.4%, 44.6% and 11.3%, respectively. Ravinder *et al.*,[10] observed posterior subcapsular cataract (36%) being was most common and was seen in 36 patients. Nuclear cataract of grade 2 and grade 3 was reported in 7% and 12% of patients. In 41% of patients, there was presence of two cataracts in combination among which nuclear plus posterior subcapsular was most common.

Among 82 patients, Ermiss *et al.*[12] reported posterior subcapsular cataract, cortical cataract, nuclear cataract, and mixed type cataract in 21 (25.6%), 29 (35.4%), 18 (22.0%) and 14 (17.1%) eyes, respectively.

These data indicate prevalence of each type of cataract may vary in different regions. However, posterior subcapsular and nuclear cataract are observed to be commonly encountered cataracts than other types.

5.2 Intraoperative Complications

Overall rate of intraoperative complication in our study was 9.1%. Study from Ravinder *et al.*,[10] reported intraoperative complications in 17% of patients. In a study from Misra *et al.*,[13] the incidence of intraoperative complications in the non-vitrectomized eyes undergoing PE was 1.8% (34 of 1883 patients). Rutar *et al.*,[14] reported major intraoperative complication rate of 4.7%. Robin *et al.*,[15] reported complication rate of 21.7%. In a study from Ng *et al.*,[11] the observed rate of intraoperative complication during Phacoemulsification was 7%.

These findings demonstrated that rate of intraoperative complications in PE varies from nearly 2% to 22%. Our observation suggests a relatively lower rate of complications in our set up.

Among the complications, difficulty in nucleus emulsification (5.4%) was most common followed by posterior capsular rent (2.2%), CCC-related complication (1.6%). Iris prolapse occurred in 1.1% whereas detachment of Descemet's membrane, vitreous loss and nucleus drop were noted in one (0.5%) patient each. Zare M *et al.*,[16] reported vitreous loss in 7.9% and it was 5-fold greater in the hands of residents as compared to fellows. The highest rate of vitreous loss occurred in patients with dense nuclear cataracts.

Among 320 patients who underwent Phacoemulsification, Rutar *et al.*,[14] reported major complications in 4.7% patients that included vitreous loss (n = 10, 3.1%). Other major complications included dropped nuclear fragments requiring further surgery (n = 3, 1.0%), malpositioned IOL requiring reoperation (n = 2, 0.6%), wrong IOL power requiring reoperation (n = 1, 0.3%), corneal wound burn (n = 1, 0.3%), and postoperative iris prolapse (n = 1, n = 0.3). Minor complications were reported in 8.8%. These included failure of a complete curvilinear capsulorrhexis, (n = 18, 5.6%), followed by intraoperative iris prolapse (n = 8, 2.5%) and unexpected hyperopic refractive outcomes that were not due to a surgeon error in IOL selection (n = 4, 1.3%). In 600 surgeries, Briszi *et al.*,[17] reported complications in 23 (3.8 %) cases. In posterior capsular tear 23 eyes (3.8 %) with vitreous loss in 17 eyes (2.8%)

and loss of lenticular fragments into the vitreous in seven eyes (1.2%). Eyes having dense nuclear sclerosis (p = 0.002) and white cataracts (p = 0.019) were found to be associated with a statistically significantly greater incidence of posterior capsular tears and vitreous loss (p = 0.007 and p = 0.027 respectively).

One of the serious intraoperative complication was posterior capsular rupture with vitreous loss. The rate of PCR was low in our study compared to all the previous studies mentioned in table. As soon as PCR was noted aspiration flow rate was reduced.

Anterior chamber was filled with viscoelastic material. The remnant cortical matter was carefully removed. Vitrectomy was performed and three-piece IOLs were implanted.

Absence of other complications such corneal burn, zonular dehiscence, or tunnel- related complications possibly suggest delivery of excellent care in Phacoemulsification procedure at our center.

Though multiple factors can be contributory to the occurrence of intraoperative complications, surgeon experience identified to be one of the important contributors. In this regard, Robin *et al.*[15] identified that the risk of intraoperative complications declines with increasing number of procedures performed by the surgeon. Rutar *et al.*,[14] observed that residents performing Phacoemulsification surgery achieved a low overall rate of major complications. However, specific features of cataracts, such as mature nuclei and zonular pathology, carried increased intraoperative risk. Anticipating risk may help to decrease surgical complications further and to counsel patients appropriately.

5.3 Phacoemulsification Time

Mean phaco time was 1.1 ± 0.4 min. In majority of patients, phaco time was <1 min (48.4%) followed by 1 to 1.5 min (37.1%), 1.6 to 2 min (11.8%), and >2 min

(2.7%). Robin *et al.*[15] observed the mean phaco time of 2.6 ± 1.3 min, 1.6 ± 0.7 min, and 2.3 ± 2.0 min in Phacoemulsification performed by surgeon, 1, 2 and 3, respectively. Ravinder *et al.*,[10] reported that Phacoemulsification time lasted <1 min in 33% of patients, 1 to 2 min in 63% of patients and >2 min in in 4% of patients. This indicates that majority of the surgeons can complete phaco in less than 2 minutes. Proportion of patients with phaco time of <1 min was nearly similar to those of 1 to 2 min indicating a rapid and successive completion of phaco at our center.

5.4 Conversion to SICS

In our study, only 2.2% of patients had conversion to SICS. Ravinder *et al.*,[10] reported 4% rate of conversion to SICS. This was required especially in patients where nucleus could not be emulsified. Rutar *et al.*,[14] reported conversion to ECCE in 1.3% of patients planned for PE. Carifi *et al.*,[18] reported that the conversion rate to manual extracapsular cataract extraction was 2%.

When a PCR occurs early in the surgery, with most of the nucleus still present, it is safer to stop phacoemulsification and convert to a large-incision cataract surgery such as Extracapsular Cataract Extraction (ECCE) or Manual Small-Incision Cataract Surgery (MSICS). The MSICS wound has valve architecture that closes automatically during surgery, is more secure, does not open up with minor injuries, and produces a postoperative astigmatism that is more predictable. Vitrectomy is easier to perform in MSICS as the chamber is closed and remains deep. Conversion to SICS may be necessary when phacoemulsification becomes more challenging due to the density of the cataract, loss of the capsulorhexis, zonular dialysis, iridodialysis, corneal haze, or other reasons necessitating discontinuation of Phacoemulsification[19].

5.5 Visual Acuity in Post-operative Period

Majority of the patients had vision of 6/6 on first postoperative day and proportion gradually increased to 56%, on day 7 and 77.5% by day 90. Also, majority of the patients had vision >6/18 over the follow-up period indicating good vision in them. Further, vision changes according to complications were assessed in our study. None of the patients in any complication had vision <6/18 after 90 days of surgery. Thus, complications had no substantial effect on visual outcome. Also, we observed vision changes in association with phaco time. By the end of 90 days, all patients with phaco time <1 min, 1 to 1.5 min and >2 min achieved good visual acuity (>6/18) with exception of only one patient in group of phaco time 1.6 to 2 min who had vision of 6/18. This clearly indicates minimal effect of phaco time on visual recovery after 90 days.

Rutar *et al.*,[14] observed that Mean postoperative best corrected visual acuity was 20/26. A major complication decreased the likelihood of achieving 20/40 or better visual acuity within 90 days of surgery (95% of uncomplicated eyes vs. 71% of complicated eyes).

Oderinlo *et al.*,[20] reported that 85.7% of the patients met the refractive aim after PE. An unaided visual acuity of 6/18 and better was achieved in 85.9% at 3 months. Best-corrected vision of 6/18 and better was achieved by 98.0% at 3 months. Compared to these studies, visual outcome was much better in our study indicating better visual correction and lesser impact of intraoperative complications on visual outcome. This has been supported by observation from Yap and Heng[21] who reported that even if complicated by posterior capsule rupture or zonulysis, PE is compatible with good visual outcome. This can be achieved with prompt attention to the management of complications.

6. Conclusion

Phacoemulsification is one of primary surgical treatment for cataract extraction and is widely used globally. Though Phacoemulsification is relatively safe with much lesser complication than other surgical treatments, it requires skill to perform it uneventfully. Multiple intraoperative and postoperative complications can occur if surgery is not performed meticulously.

In our study, rates of intraoperative complication was 9.1% that is comparable to previous reports. Difficulty in nucleus emulsification was the most common complication.

Other complications such as posterior capsular rent, iris prolapse detachment of Descemet's membrane, vitreous loss and nucleus drop occurred with lesser frequency. Prompt management of complications can help achieve good postoperative visual recovery. In nearly all the patients, we could achieve postoperative visual acuity of >6/18 by the end of 90 days. Thus, Phacoemulsification associated intraoperative complications necessitate prompt recognition and management to achieve optimal visual outcomes in postoperative period.

7. Conflict of Interest

None to declare.

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