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VISUAL OUTCOME FOLLOWING INTRAOPERATIVE POSTERIOR CAPSULAR RUPTURE DURING PHACOEMULSIFICATION IN A TERTIARY TEACHING INSTITUTE OF EAST INDIA: A RETROSPECTIVE STUDY

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ABSTRACT

Introduction: Posterior capsular rent (PCR) is a common complication of phacoemulsification.
Aim: To show the outcomes of management of intraoperative PCR in a tertiary teaching institute in East India.
Methodology: Retrospective observational study. 100 patients with history of PCR during phacoemulsification were followed up for 6 months. Best corrected visual acuity (BCVA) and other anterior and posterior segment findings on postoperative day 1, 1 month, 3 months and 6 months were noted.
Results: The patients were divided into 2 groups, group A: operated by consultants (n=70) and group B: operated by trainee surgeons under guidance of consultant (n=30). There was no significant difference in BCVA between the 2 groups on final follow up visit at 6 months (p=0.38).
Conclusion: Early recognition and proper management of PCR can prevent visual disablement and further complications.

KEYWORDS : Posterior capsular rent (PCR), phacoemulsification.

INTRODUCTION:

A common complication of phacoemulsification is posterior capsular rupture (PCR) which is defined as a breach in the posterior capsule of lens.[1] PCR can lead to permanent visual disability if not diagnosed early and managed properly. Expert senior surgeons as well as trainee surgeons can face an intraoperative PCR with slightly higher incidences in junior trainees. Incidence of PCR varies between 0.2% to 14%. [2] Implementation of recent technologies and instruments have reduced the rate of PCR to 0.45%–5.2%.[3]

A proper and timely management of PCR leads to a good visual outcome. In this retrospective study we have aimed to show the outcomes of management of intraoperative PCR in a tertiary teaching institute in East India.

METHODOLOGY:

100 adult patients (100 eyes) with history of PCR during phacoemulsification who attended the outpatient department (OPD) from November 2020 to January 2021 with a minimum regular follow up period of 6 months were included in the study. Patients less than 18 years with history of trauma, with complicated/ subluxated cataract were excluded. Patients with any retinal/choroidal pathology or optic atrophy and those with history of any previous intraocular surgery were also not included. Clearance from the hospital ethics committee was taken. All study procedures confirmed to the tenets of the Declaration of Helsinki for research involving human subjects. Informed written consent was obtained from all patients

Demographic details of the patients and history of any chronic illness were noted. The preoperative ophthalmological examination findings including best corrected visual acuity (BCVA) using LogMAR chart (Logarithm of Minimum Angle of Resolution), intraocular pressure measurement with non-contact tonometer, slit-lamp biomicroscopic findings, biometry and dilated fundus examination with indirect ophthalmoscopy and 20 D and 90 D lens were noted from the hospital records and previous documents. The cataract was graded using the WHO simplified classification[19] while biometry was done using SRK-T formula. Patients with hard cataract where fundus details were not visible, ultrasound B scan findings for the same eye were noted along with fundus examination findings of the other eye. The details regarding the management of PCR were recorded from the hospital records and discharge certificates with patient. Any kind of surgical complication during the management was also noted. Type of intra-ocular lens (IOL) implantation and time of implantation were also noted.

BCVA and other anterior and posterior segment findings on postoperative day 1, 1, 3 and 6 months were noted from OPD records. A BCVA≤ LogMAR 0.3 was considered as success. For patients with BCVA> LogMAR 0.3 at final follow up, the cause was investigated and noted. For patients suspected to have cystoid macular edema (CME), Optical Coherence Tomography (OCT) was performed to confirm the diagnosis (Heidelberg Spectralis).

Surgical management: Anterior vitrectomy was performed after the diagnosis of intraoperative PCR by the primary surgeon in case of group A patients and by the guide consultant surgeon in case of group B patients. If substantial part of the posterior capsule was retained then a posterior capsulorrhexis was attempted and Foldable IOL was placed in bag. If large tear was noted then Multipiece IOL was attempted to be placed in the ciliary sulcus. If this was also not possible an Iris Claw lens was implanted in same or second sitting. In case of loss of nuclear fragment in vitreous or large rent with substantial vitreous prolapse in anterior chamber, pars plana vitrectomy was done by vitreo-retinal surgeon and a secondary IOL usually Scleral fixated IOL (SFIOL) was implanted after 1 month (sutured or intrascleral sutureless).

Statistical analysis: All statistical analyses were performed using the SPSS 21.0. For continuous variables, t-test or Anova test was performed for data with normal distribution, while a corresponding non-parametric test was used for abnormal distribution data. For categorical variables, Pearson's chi-square test or Fisher's exact test was used. A p-value of less than 0.05 was considered statistically significant.

RESULTS:

The patients were divided into 2 groups, group A patients (n=70) were operated by consultants while group B (n=30) were operated by trainee surgeons under guidance of consultant. The demographic characteristics and preoperative vision have been described in Table 1.

In group A, 12 patients (17.14%) had hard mature cataract while 12 (17.14%) had Posterior Polar cataract. In group B, 6 (20%) had hard mature cataract (Table 2). 64 patients (91.43%) in group A had some specific pre-existing risk factors for posterior capsular rupture like small pupil, high arched brow with deep set eyes, etc. while only 40% patients of group B had these risk factors (p<0.0001) (Table 2).

5 patients (7.14%) required pars plana vitrectomy (PPV) in group A as compared to 9 (30%) in group B (Table 3). The BCVA attained by both category of patients, that is, those who underwent anterior vitrectomy and those who underwent PPV were similar and did not show any significant difference (group A: p=0.06, group B: p=0.41).

In group A, 16 (85.72%) underwent posterior chamber IOL (PCIOL) while 5 (7.14%) underwent a Scleral fixated IOL (SFIOL) implantation. In group B, 18 (60%) underwent PCIOL while 7 (23.33%) underwent SFIOL implantation. 7.14% of the patients underwent Iris claw lens implantation in group A while in group B it was 16.67%. There was no significant difference in the BCVA at final visit between those who underwent PCIOL, SFIOL and Iris claw lens implantation for group A and B (group A: p=0.08, group B: p=0.61). There was no significant difference in the final visual outcomes between those who underwent IOL implantation in the first sitting

itself and those who had secondary IOL implantation 1 month later (group A: p=0.06, group B: p=0.42) (Table 3).

Surgical complications during pars plana vitrectomy were seen in 5 cases (2 in group A and 3 in group B) which included iatrogenic retinal breaks. Barrage endolaser photocoagulation (2-3 rows) were done surrounding the breaks and air was used as tamponade. There were no incidences of endophthalmitis or retinal detachment.

There was significant improvement of vision from preoperative BCVA at each follow up in Group A (p<0.0001). There was no significant difference in vision on first postoperative day from preoperative BCVA (p=0.198) in group B but there was significant improvement on subsequent visits (p<0.0001). There was no significant difference in BCVA between the 2 groups on final follow up visit at 6 months (p=0.38) (Chart 1).

23% of the patients had BCVA> LogMAR 0.3 at final follow up visit at 6 months. 6 had pre-existing leucomatous corneal opacity while 6 patients had glaucoma with stage 1-2 field defect (Richard Mills classification).[20] 2 patients had developed corneal decompensation following surgical management of the posterior capsular rupture, 6 had cystoid macular edema while 3 patients had recurrent uveitis (1 with sulcus IOL and 2 with iris claw lens) (Table 4).

Table 1: Demographic characteristics and preoperative vision:

	Group A (n=70)	Group B (n=30)	p value
AGE (years)			
Mean	61.45±8.91	61.86±7.9	0.414
Range	45-78	51-76	
GENDER			
Male : Female	46:24	18:12	0.58
LATERALITY			
Right eye : Left eye	22:48	20:10	<0.0001
SYSTEMIC DISORDERS			
Diabetes (%)	2 (2.8%)	4 (13.3%)	
Hypertension (%)	2 (2.8%)	4 (13.3%)	
Both Diabetes + Hypertension (%)	0	3 (10%)	
Cardiovascular disorder (%)	2 (2.8%)	0	
PREOPERATIVE VISION			
Mean	1.49±1.09	1.54±1.18	0.416
Range	0.48-3.25	0.3-3.25	

Table 2: Cataract related data:

	Group A (n=70)	Group B (n=30)
TYPE OF CATARACT		
Nuclear Cataract grade 1 with Posterior Subcapsular Cataract (%)	2 (2.87%)	2 (6.66%)
Nuclear Cataract grade 2 (%)	14 (20%)	6 (20%)
Nuclear Cataract grade 3 (%)	18 (25.71%)	8 (26.67%)
Nuclear Cataract grade 4 (%)	12 (17.14%)	8 (26.67%)
Mature cataract (%)	12 (17.14%)	6 (20%)
Posterior polar cataract (%)	12 (17.14%)	0
RISK FACTORS (%)	64 (91.43%)	12 (40%)
Small Pupil (%)	20 (28.57%)	2 (6.67%)
High myopia (%)	8 (11.43%)	4 (13.33%)
Poor visibility (%)	6 (8.57%)	1 (3.33%)
Pseudoexfoliation (%)	10 (14.29%)	0
Posterior polar cataract (%)	12 (17.14%)	0
High arched brow/ Deep set eyes (%)	8 (11.43%)	5 (16.67%)

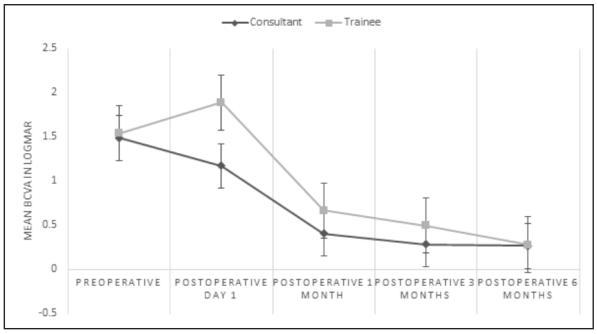
Table 3: Surgical management related data:

SURGERY RELATED VARIABLES		Group B(n=30)			Group B(n=30)		
		No. (%)	Mean BCVA at 6 months (LogMAR)	p value	No. (%)	Mean BCVA at 6 months (LogMAR)	p value
TYPE OF SURGICAL MANAGEMENT	Anterior vitrectomy	65 (92.86%)	0.4±0.42	0.06	21 (70%)	0.29±0.18	0.41
	Pars plana vitrectomy	5 (7.14%)	0.25±0.71		9 (30%)	0.27±0.34	
TYPE OF IOL	Posterior chamber IOL	60 (85.72%)	0.24±0.13	0.08	18 (60%)	0.25±0.33	0.61
	Scleral fixated IOL	5 (7.14%)	0.37±0.09		7 (23.33%)	0.28±0.14	
	Iris claw lens	5 (7.14%)	0.48±0.31		5 (16.67%)	0.39±0.41	
TIME OF IOL IMPLANTATION	Primary	65 (92.86%)	0.4±0.42	0.06	20 (66.67%)	0.27±0.31	0.42
	Secondary	5 (7.14%)	0.25±0.71		10 (33.33%)	0.29±0.26	

Table 4: Causes of BCVA<LogMAR 0.3 at final follow up visit:

Cause	Final follow up (n=100)
Pre-existing eye disease (%)	12 (12%)
Leucomatous corneal opacity (%)	6 (6%)
Primary angle closure glaucoma (%)	3 (3%)
Primary open angle glaucoma (%)	3 (3%)
Surgical complications post vitrectomy and IOL implantation (%)	11 (11%)
Corneal decompensation (%)	2 (2%)
CME (%)	6 (6%)
Recurrent uveitis (%)	3 (3%)

Chart 1: Comparison between preoperative and postoperative vision:



DISCUSSION:

PCR can lead to poor visual outcomes with repeated surgeries requiring regular follow ups over a long period which can be taxing for the surgeon as well as for the patient. Poor visibility due to corneal opacity, arcus senilis, pterygium or high brow with deep set eyes are few known extraocular risk factors for PCR. Intraoperative floppy iris syndrome (IFIS) reduces the workspace so iris hooks or pupillary expanders like B Hex ring should be used in such cases.[7] Deep anterior chamber as in high myopia, pseudoexfoliation syndrome, traumatic subluxated cataracts, hard brunescent/ mature cataracts and posterior polar cataracts are associated with high risk of PCR.[4,5,6] Preoperative identification of these conditions with patient counselling is essential in such cases. More expertise is required for the management of such cases and therefore such patients were mostly operated upon by senior consultants rather than beginner trainee surgeons in our study (p<0.0001).

Intraoperatively, early recognition of PCR by signs like pupillary snap is important as continued intraocular manoeuvres of phacoemulsification in a case with PCR cause fluctuations in anterior chamber depth and can enlarge the tear leading to nucleus drop and vitreous prolapse.[8] In majority of the patients in our study, the PCR was recognised early and there was no loss of lens fragment in the vitreous. 14% of the patients (5 in group A and 9 in group B) however had nuclear fragment drop into the vitreous and therefore underwent pars plana vitrectomy. Majority of such patients belonged to group B emphasizing the importance of early recognition of PCR for the trainee surgeons.

In cases where the capsule-bag complex was compromised, SFIOL, Iris claw lens and ACIOL (anterior chamber IOL) can be used. Of these ACIOL is usually less preferred due to postoperative complications namely, endothelial cell loss, secondary glaucoma and severe uveitis (UGH syndrome: uveitis, glaucoma, hyphema).[9] Retropupillary iris claw lens was implanted in 10 patients in our study of which 2 developed recurrent uveitis with opacification of the lens by six months and were planned for IOL exchange. Iris claw lens implantation is time saving with short learning curve but its use is limited by conditions of iris like iris atrophy and pupillary distortion, pigment dispersion over lens causing opacification. SFIOL on the

other hand is a complicated, time consuming surgery requiring higher expertise and there can be problems of suture erosion, decentration of IOL and CME.[10,11] Studies have shown no significant difference in the outcomes of Iris claw and SFIOL though Madhivanan *et al* has reported a longer visual rehabilitation time with iris claw lens as compared to SFIOL.[12,13] In our study no significant difference was noted between the final visual outcomes of the 3 types of IOL implantation in both groups (p=0.8, p=0.61). A primary IOL implantation is favoured by some surgeons as it is found to prevent further vitreous loss. In our study, 85% of the patients had a primary IOL implantation while 15% underwent secondary IOL implantation and we did not find any statistical difference between the visual outcomes of these two groups (group A: p=0.06, group B: p=0.42).

PCR is known to cause striate keratopathy, corneal edema, glaucoma, uveitis, and fibrinous reaction, pseudophakic bullous keratopathy, glaucoma, CME, endophthalmitis and retinal detachment in the long run.[14,15] 2 patients in our study had decompensated cornea following surgery with BCVA LogMAR 1. They were planned for optical keratoplasty. 6% of the patients in our study had post-operative CME (Irvine-Gass syndrome). Incidence of pseudophakic CME post phacoemulsification is reported to vary between 1% to 30%.[16] NSAIDS (non steroidal anti-inflammatory agents), steroids and anti-VEGFs are some of the treatment options available for pseudophakic CME.[17,18] In our study NSAIDS was prescribed to these patients and they were kept under observation with advice for further follow up.

CONCLUSION:

With early recognition and proper management of PCR, dreadful complications like nucleus fragment drop in vitreous can be prevented and there can be a good visual outcome. Trainee surgeons should be guided to recognize the early signs of PCR for a better management of the case.

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