Outcomes of Phacoemulsification as a Treatment Modality in Patients of Acute Primary Angle Closure Glaucoma with Co-Existing Cataract

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ABSTRACT

Glaucoma, the second leading cause of blindness worldwide, is often characterized by progressive optic nerve damage due to elevated Intraocular Pressure (IOP). Primary Angle Closure Glaucoma (PACG) results from structural anomalies that cause the iris to obstruct the trabecular meshwork, hindering aqueous humor drainage. Acute PACG attacks are typically managed with pressure-lowering medications followed by surgical interventions such as peripheral iridectomy or iridotomy. Recent studies have suggested that primary phacoemulsification and Intraocular Lens (IOL) implantation may not only resolve acute PACG attacks but also provide long-term IOP control. This prospective, non-comparative, observational study aimed to evaluate the effects of primary phacoemulsification and IOL implantation in patients with acute PACG and coexisting cataract. A total of 30 patients aged 50–80 years were enrolled, and their IOP, visual acuity, Anterior Chamber Depth (ACD), use of ant glaucoma medications, and angle opening were assessed before and after surgery. Preoperative IOP averaged 31.5 ± 13.7 mmHg, which decreased significantly to 12.83 ± 3.13 mmHg at 6 months, with a success rate of 96.66%. Visual acuity improved from 1.38 ± 0.71 LogMAR to 0.35 ± 0.16 LogMAR. The number of ant glaucoma medications decreased from 2.23 ± 0.77 preoperatively to 0.27 ± 0.52 postoperatively. Gonioscopy and ACD measurements also showed significant improvements. Few complications, such as corneal edema and iritis, were noted. The results suggest that phacoemulsification and IOL implantation is a safe and effective alternative to conventional treatments for acute PACG with cataract, providing better IOP control, visual improvement, and reduced dependence on ant glaucoma medications.

KEYWORDS
Glaucoma, Primary angle closure glaucoma, Phacoemulsification, Intraocular lens, Intraocular pressure

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INTRODUCTION

Glaucoma is considered to be the second most prevalent cause of blindness globally, next to only the other most common cause which is cataract.[1] It is characterized by a persistent, gradually progressing optic nerve disorder resulting from various ocular conditions, culminating in optic nerve deterioration and loss of visual function.[2] The primary risk factor associated with glaucoma is, raised intraocular pressure.[3]

Angle closure glaucoma is a condition originating from any deformity in the structural configuration of the eye. Its defining feature involves the iris coming into close proximity or adhering to the trabecular meshwork through appositional or synechial means.[4] Such patients often present clinically with a shallow anterior chamber and a thicker lens which is positioned more anteriorly, which is different from the typical anatomy of the eye.[5]

An acute attack of primary angle closure glaucoma is medically managed by intraocular pressure lowering agents, both systemic and local.[6] Following the resolution of the acute attack, we typically proceed with peripheral iridectomy or iridotomy, which can be done either surgically or using laser.[7] The management aims to relieve the pupillary blockage and establish a new pathway for the drainage of aqueous humor.[8] However, a successful PI does not always result in satisfactory IOP control.[9]

Newer evidence indicates that primary lens extraction not only resolves acute PACG attacks but also leads to long-term Intraocular Pressure (IOP) control.[10]

The objective of the current study was to evaluate the effects of primary phacoemulsification and Intraocular Lens (IOL) implantation on IOP, vision, Anterior Chamber Depth (ACD), use of ant glaucoma medications, and angle opening, in eyes with acute PACG and coexisting cataract.[11]

MATERIALS AND METHODS

A randomized, prospective, non-comparative, observational study was carried out over a period of 1 year in the Ophthalmology department of BMHRC, Bhopal, after receiving approval from the Institutional Ethical Committee.[12] Written informed consent was duly taken from all the study subjects.[13]

Inclusion criteria

The clinical diagnostic criteria which were considered for including patients were as follows:

- Presentation with typical symptoms (ocular pain, blurry or halo vision, nausea or vomiting).
- Acute increase in IOP to above 22 mmHg.
- Presence of ciliary flush, microcystic corneal edema, mid-dilated pupil.
- Occludable angle.

Patients with secondary glaucoma, history of uveitis, ocular trauma, previous ocular surgeries, or other ocular diseases were excluded.[14] The enrolled patients also presented with visually significant cataract.[15]

After the diagnosis of acute PACG was made, these patients received first-line medical treatment for IOP control. This included a combination of topical and systemic pressure lowering agents.[16]

Pilocarpine therapy was discontinued preoperatively 7 days prior to surgery.[17]

The enrolled patients were subjected to a complete ocular examination before surgery, including Best-Corrected Visual Acuity (BCVA), IOP, visual field assessment, keratometry, slit-lamp examination, fundus examination and gonioscopy.[18] Contact A-scan biomicroscopy was performed to measure the anterior chamber depth and axial length and to calculate IOL power.[19] Visual acuity was measured with the Landolt C chart, and the value was converted into that in the logarithm of the Minimum Angle of Resolution (logMAR).[20]

All surgical procedures were performed by one surgeon under all aspetic precautions. After anesthesia and sterile draping, a standard phacoemulsification was done by 2.8 mm clear corneal incision. After injection of viscoelastic materials for anterior chamber maintenance, a Continuous Curvilinear Capsulorrhexis (CCC) and hydro dissection was performed. The lens phacoemulsified, and the cortical remnants removed by irrigation and aspiration. A foldable hydrophobic acrylic IOL was implanted in the bag. After complete removal of viscoelastic materials, the clear corneal incision hydrosealed. Postoperative medication included a moxifloxacin e/d 4 times a day, prednisolone eye drops 8 times a day and lubricating eye drop 4 times a day. The dosage was tapered within 45 days depending on the degree of postoperative inflammation.

Patients were followed up the morning after surgery, discharged and called for follow up on 1st week, 3rd week and 1st, 6th month postoperatively. A complete ocular examination was performed each time, including Visual Acuity (VA), IOP, slit-lamp examination, and fundus examination. Gonioscopy, disc assessment visual field examination and ocular biometry such as AC depth was recorded at 3rd and 6th month postoperatively.

Statistical analysis

Continuous variables were expressed as mean ± Standard Deviation (SD), and categorical data were represented by number (n) and percentage (%). Variables were compared using a paired t-test. IOP at different time points was analyzed by repeated measure one-way ANOVA. All statistical assessments were 2-sided, and a p level of 0.05 was considered statistically significant.

RESULTS

After obtaining written informed consent, 30 patients in the age bracket of 50 to 80 years were taken up for the subject study, 33.33% being in the age group of 61-65 years. The male to female ratio was 20 *i.e.*, 66.67% female and 10 *i.e.,* 33.33% males.

Intraocular pressure

Mean IOP before operation was 31.5 ± 13.678 mmHg, which reduced significantly after 6 months to 12.83 ± 3.13 mmHg. In one patient, IOP was not controlled even at 6 months postoperative for which further filtering surgery was done. The success of the study which is IOP<21 mmHg was 96.66% (Table 1).

IOP in mm of Hg				95% C.I.		Paired T-Test		
Pre op IOP		After 6 month						
Mean	SD	Mean	SD	Lower	Upper	T-value	P-value	
31.5	13.678	12.83	3.13	13.358	23.975	7.192	<0.01	Significant

Table 1. Postoperative Changes in Intraocular Pressure.

Visual acuity

BCVA increased from pre-op (1.38 ± 0.71 LogMAR *i.e.,* FC1m to 6/24) to post-op (0.35 ± 0.16 LogMAR *i.e.,* 6/18 to 6/9), which was statistically significant (Table 2).

Best corrected visual acuity LogMAR				95% C.I.		Paired T- Test		
Pre op		After 6 month						
Mean	SD	Mean	SD	Lower	Upper	T-value	P-value	
1.38	0.71	0.357	0.1633	0.7707	1.275	8.285	<0.01	Significant

Table 2. Post-operative Change in Visual Acuity.

Medications

Medications required pre-operative (2.23 ± 0.77) decreased to post-operative (0.27 ± 0.52). Total 7 patients required post-operative medications, out of which 6 required only for first post-operative week and one underwent further filtering surgery at the end of 6 months (Table 3).

Medications				95% C.I.		Paired T- Test		
Pre op		Post op						
Mean	SD	Mean	SD	Lower	Upper	T-value	P-value	
2.23	0.774	0.27	0.521	1.634	2.299	12.104	<0.01	Significant

Table 3. Post-operative Dependence on Antiglaucoma Medications.

Gonioscopy grading

Mean Schaffer gonioscopy grading was increased from pre-operative 0.94 ± 0.62 to post-operative 2.61 ± 0.44 which was statistically significant.

Mean anterior chamber depth

Mean anterior chamber depth was significantly increased from 1.97 ± 0.13 to 3.08 ± 0.15 postoperatively (Table 4).

Anterior chamber depth				95% C.I.		Paired T- Test		
Pre op		Post op						
Mean	SD	Mean	SD	Lower	Upper	T-value	P-value	
1.97	0.1368	3.08	0.157	-1.178	-1.035	-31.72	<0.01	Significant

Table 4. Post-operative Anterior Chamber Depth Changes.

Complications

Very few complications were noted both intraoperatively and post operatively. Corneal edema (30%), early post-operative IOP spike (20%) and iritis (16.66%) were the main post-operative complications noted (Table 5).

Intraoperative	Number of patients	Percentage (%)
1). Capsular tear	1	3.33%
Postoperative		
1). Hyphaema	1	3.33%
2). Corneal edema	9	30%
3). Early post-op IOP spike	6	20%
4). Iritis	5	16.66%
5). Further filtering surgery	1	3.33%

Table 5. Few Complications of Both Intraoperative and Post-operative.

DISCUSSION

The crystalline lens significantly contributes to the pathogenesis of angle closure glaucoma. As the age increases the thickening of the crystalline lens causes pupillary block due to iridolenticular apposition. Removing the crystalline lens would deepen the anterior chamber, relieve the pupillary block and widen the angle. It stands as the primary treatment method that would decrease, if not eliminate, the underlying anatomical predisposition to angle closure glaucoma. Markowitz and Morin defined the Lens Thickness–to–Axial Length ratio (LT/AL) as a unifying index for biometric assessment of patients with ACG. Patients with a greater LT/AL were more predisposed to acute angle-closure attack.

Cataract surgery in angle closure patients is generally more challenging and complicated than in normal eyes because of the shallow anterior chamber. The shallow anterior chamber provides limited room for manoeuvring the nucleus, hence care must be taken regarding the power used for phacoemulsification. However, with the reduction of the nucleus size after several sculpting, more room is created leading to deepening of the anterior chamber, making the subsequent procedures easier. Also the small pupil and the atonic iris that are commonly found in post-acute-PAC eyes raises another problem. The atonic iris has a tendency to plug surgical wounds, which needs to be addressed very carefully.

Lens extraction presents a viable option for achieving successful Intraocular Pressure (IOP) management with lower associated risks compared to filtration surgery, in patients of acute angle closure glaucoma. Lens extraction also aids in controlling Intraocular Pressure (IOP) even if Peripheral Anterior Synechiae (PAS) has occurred. In such cases, the remaining open angle may compensate for the functional loss caused by the closed portions of the angle. Our results showed significantly reduced IOP, decreased use of antiglaucoma medications, and increased anterior chamber depth after phacoemulsification and IOL implantation in patients with acute PACG. These results were consistent with previous similar studies and suggest that primary cataract extraction can be considered an alternative therapeutic option for medically uncontrolled acute PAC.

CONCLUSION

In conclusion, the main objective of this study *i.e.*, intraocular pressure was reduced significantly in all cases postoperatively, except one. The success rate of this study at the end of 6 months is 96.66%. In all patients, visual acuity increased postoperatively. The number and duration of antiglaucoma medications was also reduced. The angle was significantly more open and the anterior chamber depth significantly increased postoperatively.

This study proves the safety and efficacy of phacoemulsification with primary intraocular lens implantation as a treatment in acute angle closure glaucoma patients with significant cataract.

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