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CLINICAL OUTCOMES OF CATARACT SURGERY IN EYES WITH PRIMARY ANGLE CLOSURE /PRIMARY ANGLE CLOSURE GLAUCOMA.

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ABSTRACT **Purpose:** To evaluate the clinical outcomes of visual acuity (VA), Intraocular pressure (IOP) and Anterior chamber angle status in Primary angle Closure/Primary Angle Closure Glaucoma (PAC/PACG) patients after phacoemulsification. **Methods:** A prospective study conducted from August 2018 to May 2019. 30 patients with cataract and PAC/PACG, undergoing phacoemulsification were enrolled in this study after taking informed consent. Statistical analysis performed by using JASP 0.8 version and MICROSOFT EXCEL 2013. **Results :** 63% were females and 37% males. Mean age of the patients was 56.9 years ± 1.1 years. The mean preoperative and post-operative best corrected visual acuity (BCVA) at 3 months were 0.91± 0.47 and 0.15± 0.09 (logMAR) respectively. The mean preoperative IOP was 22.23± 3.92 Standard Deviation (SD), mean IOP on postoperative day 1 was 15.6 ± 2.59 SD with P value <0.001. At 3 months post-operatively, mean IOP was 12.33± 1.67SD with a P value <0.001. Gonioscopically, majority of the eyes had a 10º angle width widening post-operatively. **Conclusion:** Phacoemulsification with IOL implantation is a safe and effective procedure leading to lowering of IOP, widening of anterior chamber angle and improvement in BCVA.

KEYWORDS : PAC, PACG, Intraocular pressure, visual acuity, Glaucoma, phacoemulsification.

INTRODUCTION

Cataract and glaucoma are ranked as the leading causes of blindness worldwide [1,2]. Unsurprisingly, both diseases frequently coexist in the elderly population in a proportion that is likely to increase (1,2).

Prevalence of Angle closure varies with geographic region and race. Prevalence rates among Eskimos are the highest (3,4), lower for white population [5] Asians including Indians have prevalence rates in between above two (6,7). Information regarding the prevalence of glaucoma in India comes from seven population based studies (1,7-12).

These studies have reported varying prevalence of PACG (Primary Angle Closure Glaucoma) ranging from 0.5% in ACES (Aravind Comprehensive Eye Study) (1) to 4.32% for VES (Vellore Eye Study) (7) in those 40 years of age and older.For angle closure glaucoma, the blindness rates for APEDS (Andhra Pradesh Eye Diseases Survey) (8), CGS (Chennai Glaucoma Study) (rural) (9) and CGS (urban) were 16.6%, 2.9% and 5.9% respectively.

Primary Angle Closure (PAC) in an eye is defined as more than or equal to 180 degrees of Iridotrabecular contact (ITC), Elevated intraocular pressure (IOP) and no optic nerve damage or Peripheral anterior synechiae (PAS) (13,14). It tends to develop in eyes with shallow anterior chambers, anteriorly positioned lens and angle crowding (13-17). The crystalline lens plays a pivotal role in the pathogenesis of PAC due to its cardinal anatomic characteristic of being thicker, more anteriorly positioned than in unaffected eyes (13-17). The most common underlying mechanism for acute PAC is pupillary block (13,14). Hence Laser Peripheral Iridotomy (LPI) has been suggested prophylactically in the fellow eye of patients with PAC in one eye. Lens extraction in these eyes with co-existing cataract has been proposed as it serves the purpose of improving visual acuity (18-25), lowering IOP (18-22) and widening anterior chamber angle (23-25). Risk of PAC is high among women, the elderly and the hyperopic most prevalent in Asia (13,14).

Primary angle closure (PAC) if not treated in time leads to Primary angle closure glaucoma (PACG) due to repeated acute attacks. An acute attack of PAC is characterized by rise in IOP, painful red eye with blurred vision and shallow AC. Such repeated attacks lead to formation of PAS, posterior synechiae, pupillary block affecting the optic nerve head adversely (increased cup size, thinning of neuro-retinal rim, optic disc hemorrhage) leading to blinding PACG. Thus PACG is defined as more than or equal to 180 degrees of iridotrabecular contact, with PAS, elevated IOP and optic neuropathy (13,14).

PAC leading to blinding PACG is many times an incidental finding in a developing country like India unless patient has had an acute attack of angle closure.

Diagnosis relies on Slit lamp examination, Goldmann's Applanation Tonometry (GAT), Gonioscopy, Central Corneal Thickness (CCT), Visual Field Evaluation (VF), Anterior chamber depth (ACD), Fundus and specifically optic disc (OD) evaluation (13,15).

Treatment is designed to control IOP simultaneously monitoring Anterior chamber (AC) angle changes and optic nerve head condition. Cataract surgery is one of the most common surgical procedures performed worldwide and suggested to be of clinical benefit in both cataract and PAC as it eliminates an important primary pathology in development of PACG, besides removing the opacified lens and improving visual acuity, cataract surgery reduces IOP in eyes either with or without glaucoma, also widening anterior chamber angle width (26-38). Newer techniques have made only cataract surgery safe in PAC/PACG (26-38), avoiding complications of combined procedures. This study aims to assess clinical outcomes of minimally invasive cataract surgery by an experienced and well-trained surgeon using phacoemulsification with intraocular lens implant in patients with PAC/PACG as regards Visual acuity(VA), Anterior Chamber (AC) angle status and Intraocular Pressure (IOP) changes, pre and post-operatively.

MATERIALS AND METHODS

Hospital-based Prospective Observational study conducted from August 2018 to May 2019 in Mahatme Eye Bank Eye Hospital, Nagpur, Maharashtra. 30 patients with cataract and PAC/PACG, undergoing phacoemulsification were enrolled in this study after taking informed consent. Study was executed after clearance from Institutional ethics Committee. All patients with Primary Angle Closure/PACG having undergone LPI (Laser Peripheral Iridotomy) presenting for cataract surgery and willing for follow up after 3 months of surgery were included while patients undergoing combined cataract surgery and trabeculectomy, patients with secondary cause for angle closure for example: lens-induced condition and not willing for a 3 month follow up post-surgery were excluded.

Detailed history of patients complaining of diminution of vision was taken including history of any anti-glaucoma treatment, other ocular symptoms associated with diminution of vision, other systemic disorders and relevant past history. History of any acute angle closure attacks in the past and previous LPI.

Ophthalmologic examination included best-corrected visual acuity (BCVA) (using Snellen's chart & LogMAR charts), slit lamp biomicroscopy to evaluate anterior chamber status as regards depth, peripheral anterior synechiae /posterior synechiae, grade of cataract, presence of peripheral laser iridotomy opening (if done), assessment of the retina by indirect ophthalmoscopy and Goldmann's applanation tonometry gonioscopy using 2-mirror goniolens with Shaffer's grading (13).

The criterion for considering a diagnosis of angle closure was an occludable angle, defined as one in which there was a contact between iris and posterior trabecular meshwork in 2 or more quadrants with gaze in the primary position (13,14). PACG was diagnosed in eyes with an occludable drainage angle and GON (Glaucomatous Optic neuropathy) (13,14) on visual fields examination, Central corneal thickness (CCT) and Optical Coherence Tomography Retinal Nerve fibre layer (OCT-RNFL) analysis. Visual acuity with Snellen chart at 6 meters (6/6), at 20 feet (20/20), 1.0 vision in decimal charts and 0.0 logMAR are considered equivalent. Visual acuity is grouped into three categories as normal vision (Log MAR 0.1 to 0.5); moderate vision (0.6 to 1.0) and poor vision (≥1.1) as recommended by International Council of Ophthalmology (ICO) Sydney, Australia, April 20, 2002 (39).

CBC, ECG, RBS, BP and pre-anesthetic check-up was done in all cases. If any co-morbid conditions were found they were managed before surgery after consult from concerned specialist and proper precautions were taken before, during and after surgery. Anticoagulants if any were stopped 5 days before surgery. Axial length of the eye was found using A-scan or B- scan as also appropriate Intraocular lens (IOL) Power of artificial lens to be implanted. Experienced surgeon performed all procedures according to a standardized protocol.

Statistical analysis performed by using JASP 0.8 version and MICROSOFT EXCEL 2013. Estimates of the treatment effect were calculated as differences between means or as proportion ratios (for binomial outcomes) with their 95% confidence limits. For comparison of means, t tests or the nonparametric equivalents were used when appropriate. Chi-square tests were used for proportions.

RESULTS

Primary outcome variables were visual acuity (VA), IOP and gonioscopic findings in the operated eye. Patients were examined before surgery, day 1 and 3 months after surgery.

63% of the total cases were females and 37% of the cases were males. Mean age of the patients was 56.9 years ± 1.1 years (range 45-67 years). Most of the patients i.e. 14 were in the range of 51-60 years where females while 11 outnumbered the males.

The mean pre-operative and post-operative best corrected visual acuity (BCVA) at 3 months post-surgery was 0.91 ± 0.47 and 0.15 ± 0.09 logMAR units respectively. (Table 1)

Table 1: Best Corrected Visual Acuity In Enrolled Patients (pre/post Op)

	Best Corrected Visual Acuity in LogMAR (Mean ± Standard Deviation)	P-value (Compared to Preop BCVA)
Preoperative	0.91 ± 0.47	
Postoperative Day 1	0.31 ± 0.13	< 0.001*
Postoperative week 12	0.15 ± 0.09	< 0.001*

*Wilcoxon Signed Rank test

On day 1, none of the patients had poor vision, 3.3% had moderate vision and 96.7% had normal vision. (Table 2)

Table 2: BCVA at different follow-ups in PAC patients.

Vision Category (BCVA) * Snellens =LogMar	Preoperative	Postoperative Day 1	Postoperative Week 12
Poor vision < 6/60=≥ 1.1	4 (13.3%)	0	0
Moderate Vision 6/24 to 6/60 = 0.6 to 1	24 (80%)	1 (3.3%)	0
Normal Vision ≥ 6/18 = 0 to 0.5	2 (6.7%)	29 (96.7%)	30 (100%)

*BCVA = Best corrected visual acuity

At 3 months after surgery all patients (100%) had vision (BCVA) greater than 6/18 (logMAR 0 to 0.5). The mean preoperative IOP was 22.23 ± 3.92 with standard deviation (SD), mean IOP on postoperative day 1 was 15.6 ± 2.59 SD with a P value <0.001 compared to preoperative IOP. At 3 months post-operatively, mean IOP was 12.33 ± 1.67 SD with a P value < 0.001. (Wilcoxon signed rank test). (Table 3)

Table 3: Intraocular Pressure at different follow-ups in enrolled patients

	Intraocular Pressure (Mean ± Standard Deviation)	*P-value (Compared to Preop IOP)*
Preoperative	22.23 ± 3.92	
Postoperative Day 1	15.6 ± 2.59	< 0.001*
Postoperative week 12	12.33 ± 1.67	< 0.001*

*Wilcoxon Signed Rank test

Gonioscopically, using Shaffer's grading System (13), majority of the eyes had a 10° angle width widening post-operatively, in each of the four quadrants, compared with the pre-operative grading. Superior angle widening was observed in 24 eyes, nasal in 20, inferior in 19 and temporal in 21 eyes post-operatively. (Table 4)

Table 4: Gonioscopy Results

Superior Quadrant		POSTOPERATIVE			
		10º, narrow angle (extreme)	20º narrow angle	Wide Open angle	TOTAL
PRE OPERATIVE	0º (closed/ occludable angle)	4	3	0	7
	10º (extreme narrow angle)	1	19	0	20
	20º (narrow angle)	0	2	1	3
	Wide Open angle	-	-	-	-
	TOTAL	5	24	1	30
Nasal Quadrant		POSTOPERATIVE			
		10º occludable	20º may be occludable	Open angle	TOTAL
PRE OPERATIVE	0º (Closed/Occludable angle)	1	7	1	9
	10º (extreme narrow angle)	0	7	0	7
	20º (narrow angle)	0	6	7	13
	Wide Open angle	0	0	1	1
	TOTAL	1	20	9	30
Inferior Quadrant		POSTOPERATIVE			
		10º occludable	20º may be occludable	Open angle	TOTAL
PRE OPERATIVE	0º (closed/ occludable)	1	10	1	12
	10º (extreme narrow angle)	0	5	1	6
	20º (narrow angle)	0	4	5	9
	Wide Open angle	0	0	3	3
	TOTAL	1	19	10	30
Temporal Quadrant		POSTOPERATIVE			
		10º occludable	20º may be occludable	Open angle	TOTAL

PRE OPERATIVE	0º (Closed/Occludable)	1	3	0	4
	10º (extreme narrow angle)	0	18	2	20
	20º (narrow angle)	0	0	6	6
	Wide Open angle	-	-	-	-
	TOTAL	1	21	8	30

DISCUSSION

In our study we took into account the changes in 3 parameters, Visual acuity, IOP and angle status pre and post-operatively. Thirty patients were followed up for 3 months post-cataract surgery and the results analyzed.

3 patients out of 30 had Optic disc changes suggestive of long-term uncontrolled IOP leading to Optic nerve damage.

12 out of 30 patients were already on anti-glaucoma medications (AGM) for raised IOP. Of which 10 were uncontrolled on one topical anti-glaucoma medication and one uncontrolled on two anti-glaucoma medications.

This patient particularly had a pre-operative IOP of 38 mmHg on two AGMs, which was controlled pre-operatively with Hyperosmotics, LPI was performed and Cataract surgery done. Post-operatively, all patients improved as regards IOP reduction except the above patient, who had an IOP of 22 mm Hg. This rise in IOP was suggested due to post-operative inflammation in this case. However, the post-operative IOP normalized in this patient at 3 months without further need of AGM.

Three patients had post-operative inflammatory corneal oedema which subsided with topical hypersol, without additional post-operative treatment. Rest of the enrolled patients did well post-operatively, having undergone an uneventful surgery without major complications. None of the enrolled patients required AGMs post-operatively.

In our study we noted that the patients were of the age 45-67 years, mean was 56.9 ± 1.1 years. In the Shams and Foster study (28), the mean age of patients was 71 ± 8.3 years and Lam Tham CC's study (29), the mean age of the patients was 73.7 ± 8.1 years respectively. Thus, PAC/PACG with cataract occurs in people over 40 years of age.

In present study, 19 were females and 11 were males. Shams Foster study had (28) 38 females compared to 17 males and 12 females compared to 9 males in Lai Tham CC study (29) suggesting a female preponderance.

The mean corrected visual acuity (BCVA) pre-operative and post-operatively at 3 months were 0.91 ± 0.47 and 0.15 ± 0.09 (logMAR) respectively (P value <0.001). In Shams and Foster study (28), the BCVA preoperatively and post-operatively was 0.51 ± 0.36 and 0.27 ± 0.28 (logMAR) respectively with a change of -0.23 ± 0.27 and P value of 0.0001.In the Su,Chen study (34), BCVA improved from 1.14 ± 0.71 to 0.73 ± 0.53 (P=0.001). Also in the Pachimkul et al study (32), Visual Acuity improved from 0.92 logMAR to 0.53 logMAR (p<0.01). A Study by Romkens, et al (33) reported that Pre-Operative and Post-Operative Visual Acuity were 0.9 ± 0.9 and 0.2 ± 0.3 logMAR units respectively. Thus, there was significant improvement in BCVA following cataract surgery.

Our study found that mean IOP decreased from its pre-operative value of 22.23 ± 3.92 SD to 12.33 ± 1.67 at 3 months post-operatively with a p value < 0.001. Thus there was a significant reduction of nearly 9 mmHg post-surgery, which can be suggested by the effect of LPI in addition to cataract extraction.

Pachimkul et al study (32) suggested a decrease in mean IOP from 23.3 ± 10mmHg to 14.8 ± 6.5 mmHg (p<0.05) post-operatively. In Shams Foster (28) and Lai Tham CC (29) studies, the mean IOP decreased from 18.7 ± 7.3 to 14.1 ± 4 and 19.7 ± 6.1 to 15.5 ± 3.9 mm Hg post-operatively. In both these studies, there was a difference of 4 mmHg between the pre-operative and post-operative values. The results of the above studies suggested a marked reduction in IOP levels post-cataract surgery in PAC/PACG cases.

In our study, gonioscopically, there was an angle widening of about 10 degrees, in each of the four quadrants, in majority cases, postoperatively, by Shaffer's grading. Shams Foster also found widening of anterior chamber angle by minimum 10 degrees post-surgery. Pachimkul et al (32) observed an angle widening after phacoemulsification taking into account the decrease in peripheral anterior synechiae (PAS). Comparing our study with the above studies, we may suggest that phacoemulsification in eyes with PAC/PACG with co-existing cataract improves visual acuity, lowers IOP and causes angle widening. The procedure can be done sans any major complications. Moreover, the need for AGMs post-operatively can be reduced to a minimum if required.

CONCLUSION

LPI followed by phacoemulsification in patients, improved vision significantly, lowered IOP markedly besides causing widening of anterior chamber angle. Phacoemulsification with IOL implantation is a safe and effective in PAC/PACG. This procedure alone can be considered as an alternate treatment of choice for patients with medically uncontrolled PAC /PACG and coexisting cataract. Cataract surgery not only causes a reduction in IOP but also increases the anterior chamber angle width and by removal of the cataractous lens improves visual acuity in patients with PAC/PACG.

Conflict of Interest-No

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