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EVALUATION OF DIFFERENCE IN THEANTERIOR CHAMBER ANGLE FOLLOWING CATARACT SURGERY IN SENILE CATARACT.

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ABSTRACT

Purpose: To study the difference in the anterior chamber angle following cataract surgery in senile cataract .
Methods: In this observational study, 48 were diagnosed with senile cataract and posted for small incisional cataract surgery with PCIOL implantation underwent thorough ocular examination. Anterior chamber angle was evaluated with gonioscopy and VanHerick'grading while ACD, AL,LT and VCD were measured through biometry prior andafter cataract surgery, and difference was estimated.
Results: Out of 48 participants, males consisted of (47.92%) (n= 23) and females consisted
(52.08%) (n=25) of the study population. The 19 (100%) participants with Shaffer's grade 4,
17 participants with grade 3 (100%), 8 (72.73%) with grade 2 and 1 (100%) patient withgrade 1 angle preoperatively on gonioscopy became grade 4 post cataract surgery and IOLimplantation. A good association was found between cataract extraction and deepening of
angle. The mean ACD difference was 0.53mm and mean VCD difference was 1.15mm forprior and after cataract surgery values which was statistically significant ($p<0.001$).
Conclusion: This study proves that ACA and ACD change significantly following cataractsurgery with PCIOL implantation in patients with senile cataract. All patients demonstratedan increase in angle of anterior chamber as well as ACD and VCD post cataract surgery. The study shows that the patients with narrow angle or susceptibility to angle closure infuture, on undergoing cataract surgery, also benefit by preventing future development of PAC/PACG or by treatment of a preexisting case.

Keywords: Cataract surgery, senile cataract, anterior chamber angle, anteriorchamber depth, lens thickness, posterior segment depth, angle closure glaucoma .

INTRODUCTION

The second most common cause of irreversible blindness worldwide is Glaucoma.47% of Asians suffer from glaucoma , among which 87% are Angle Closure Glaucoma (ACG).[1]
Obstruction of aqueous outflow is present in Angle closure glaucoma due to apposition of iris periphery against the trabecular meshwork. It embodies as the 2nd most common form of glaucoma, but its outcome is graver due to a more chance of blindness than in patients with open angle glaucoma. A well timed and exact diagnosis is crucial in order to start the proper and definite treatment that can avoid progression to greater and irreparable impairment. The most imperative step for the diagnosis of possible or apparent angle-closure glaucoma is to assess the anterior chamber depth and the configuration of the anterior chamber angle.[2]
There is prevalence of Cataract and glaucoma in elderly population. Therefore, huge cases of glaucoma have cataractaswell, which can cause reduction invisual acuity, contrast sensitivity, and examination precision. For these reasons, manyglaucoma patients undergo cataract surgery. Cataract surgery is considered to be a positive factor that aids in the inhibition of angle closure glaucoma and reduction in IOP .
Lens removal by means of cataractsurgery can aid in preventing or treating angle closure glaucoma with severely narrowedangles.[3]
In this study, we will evaluate if anterior chamber angle widens after cataract surgery and thus, in turn benefits in preventing angle closure glaucoma attacks likely in future.
We will also look for correlation between various parameters – axial length, anterior chamber depth, lens thickness and vitreous chamber depth, before and after cataract surgery.

MATERIALS & METHODS

This prospective study was conducted at Ophthalmology Department, RL Jalappa Hospital, Kolar, Karnataka, India, from December 2019 to May 2021 and was analysed in December 2022. Total of 48 patients were included in this study .
After taking an informed consent in- depth ocular examination of all the patients was performed , which included Visual acuity recording by Snellen‘s chart ; Anterior chamber by Van Herick‘s grading of Anterior chamber Angle ; lens evaluation through Slit Lamp Biomicroscopy ; Grading of cataract was noted by slit lamp examination ; Intraocular Pressure measurement by Goldmann Applanation Tonometer ; Fundus evaluation through

direct, indirect ophthalmoscopy and slit lamp 90D Examination ; Axial length (AL), anterior chamber depth (ACD) and lens thickness (LT), Vitreous chamber depth (VCD) were estimated by A scan biometry. ; Gonioscopy was performed with Ziess four mirror gonioprism for Anterior Chamber Angle evaluation and its Shaffer‘s grading was documented.

Selected patients underwent Small Incision Cataract Surgery with posterior chamber intraocular lens implantation under peribulbar block. Surgical details and complications were noted, with all procedures performed using the same technique.

Postoperatively, ACD and VCD were measured using A-scan biometry, while the angle of the anterior chamber was evaluated through gonioscopy with a Zeiss four-mirror goniolens and Van Herick's grading on slit lamp examination at the 6-week follow-up. Postoperative values were compared to preoperative gonioscopy and Van Herick's grading. The mean differences in ACD and VCD were assessed using statistical methods.

STATISTICAL ANALYSIS

Gonioscopic grade, VH grade etc., were considered as primary outcome of interest. ACA was considered as primary explanatory variable.

Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables.

The association between categorical explanatory variables and quantitative outcome was assessed by comparing the mean values. The mean differences along with their 95% CI were presented. Independent sample t-test/ ANOVA was used to assess statistical significance. The association between explanatory variables and categorical outcomes was assessed by cross tabulation and comparison of percentages. Odds ratio along with 95% CI is presented. Chi square test/ Fisher‘s was used to test statistical significance. Univariate Binary logistic regression analysis was performed to test the association between the explanatory variables and outcome variables. P value < 0.05 was considered statistically significant. Data was analyzed by using SPSS software, V.22.

RESULTS

A total of 48 participants were included in the final analysis. Among the 48-study population, 23 (47.92%) participants were male and remaining 25 (52.08%) were female. As the study was performed on senile cataract patients, the patients included were ≥ 50

years old. The mean age of the 48 participants was 56.43 years, which ranged between 50 to 85 years.

1. Comparison of gonioscopy findings pre- and post- cataract surgery (N= no. ofparticipants)

Preoperative Gonioscopy Findings	Postoperative Gonioscopy findings	
	Grade 3	Grade 4
Grade 1 (N=1)	0 (0%)	1 (100%)
Grade 2 (N=11)	3 (27.27%)	8 (72.73%)
Grade 3 (N=17)	0 (5.88%)	17 (100%)
Grade 4 (N=19)	0	19 (100%)

Table 1- Gonioscopy Findings Pre- and Post- Cataract Surgery

Out of 19 participants with grade 4 in gonioscopy findings preoperatively, all (100%) participants remained grade 4 postoperatively. Out of 17 participants with grade 3 in gonioscopy findings preoperatively, all 17 (100%) participants had postoperative gonioscopy findings as grade 4. Out of the 11 patients with grade 2 angle preoperatively, 3 (27.27%) had grade 3 and 8 (72.73%) had grade 4 angle postoperatively. 1 patient with grade 1 angle before surgery became grade 4 (100%) post-surgery. A good association was found between cataract extraction and deepening of angle.

2. Comparison of van herick's grade pre- and post-cataract surgery

Preoperative Van Herick'S Grade	Postoperative VH Grade	
	Grade 3	Grade 4
Grade 1 (N=1)	0 (0%)	1 (100%)
Grade 2 (N=11)	3 (27.27%)	8 (72.73%)
Grade 3 (N=13)	0 (0%)	13 (100%)
Grade 4 (N=23)	0 (0%)	23 (100%)

Table 2- Van Herick's Grade Pre- And Post- Cataract Surgery

Out of 23 participants with VH grade 4 preoperatively, all of 23 (100%) participants had post-op VH grade 4. Out of 13 participants with VH grade 3 preoperatively, all of them 13 (100%) participants had post-operative VH grade 4. Out of the 11 patients with VH grade 2 preoperatively, 3 (27.27%) had grade 3 and 8 (72.73%) had VH grade 4 postoperatively. 1

patient with VH grade 1 before cataract surgery became grade 4 (100%) after surgery.

3. Comparison of mean ACD and VCD at pre and post cataract surgery

Parameter	Mean ± SD	Mean Difference	P-value
ACD for operated eye			
Pre operative (mm)	2.38 ± 0.35	0.53	<0.001
Post operative (mm)	2.91 ± 0.34		
VCD for operated eye			
Pre operative (mm)	16.16 ± 1.03	1.15	<0.001
Post operative (mm)	17.32 ± 0.91		

TABLE 3- MEAN ACD AND VCD AT PRE AND POST CATARACT SURGERY

The mean of ACD for operated eye pre-operatively was 2.38 ± 0.35mm which increased to 2.91 ± 0.34mm post-operatively, the difference between pre and post-operative values was 0.53mm which was statistically significant (p value <0.001). The mean of VCD for operated eye pre-operatively was 16.16 ± 1.03mm that increased to 17.32 ± 0.91mm post-operatively, the difference between pre and post- operative values was 1.15mm which was statistically significant (p value <0.001). There is a significant increase in the depth of anterior and posterior chambers after cataract extraction and PCIOL implantation.

DISCUSSSION

A great proportion of glaucoma cases have cataract. Several glaucoma cases undergo surgery for cataract removal. Subsequent to cataract surgery, ACD and angle parameters change significantly. Extraction of lens through cataract surgery makes further space in posterior chamber and in the angle of anterior chamber, particularly in aged people. Post cataract surgery, conformation of angle expands, and IOP reduces.[4]

A study by Simsek A et al., showed the preoperative mean ACA value to be 42.09 ± 7.490 which increased to 51.46 ± 5.630 three months after the surgery. The same study observed thevalues of AC Depth and AC Volume as 2.79 ± 0.45 mm and 124.73 ± 25.72 mm^3 preoperatively which showed statistically significant change to 3.45 ± 0.6 mm and 162.52 ± 23.79 mm^3, respectively on 3 months postoperative follow up.[5]

As per this study, the change in angle of anterior chamber after cataract removal, as observed on gonioscopy and VH grading, was seen in all the cases. While 1 patient showed noteworthy change in gonioscopic and VH grade from grade 1 (extremely narrow) to grade 4 (wide open), majority of the patients had open angle (grade 4) preoperatively that showed little difference post cataract surgery. Thus, the narrower the ACA before cataract removal, the more the difference in ACA postoperatively. 89.58% (43) patients showed Shaffer‘s grading of grade 4 on gonioscopy and 93.75% (45) patients showed grade 4 VH grading postoperatively while 10.42% (5)patients became grade 3 on Shaffer‘s grading and only 6.25% (3) on VH grading but nopatients had a narrow angle (grade 1 or grade 2) after removal of cataract.

In his study, Pereira also found a substantial increase in the opening of angle after cataract removal. There was a brilliant association between the ACA preoperative and post cataract surgery values: "the shallower the preoperative AC, the greater the postoperative deepening; the narrower the preoperative angle, the greater the postoperative opening of the angle". [6,7]

With age, the lens becomes thicker while the anterior chamber becomes narrower. This can cause difficulty in drainage of aqueous humor and consequent increase in IOP. Several studies have stated that cataract extraction can decrease IOP in glaucoma cases. As removal of cataract is expected to widen the configuration of angle, the aqueous drainage improves and IOP reduces. [8,9]

The preoperative mean Anterior chamber depth as per our study was 2.38 ± 0.35mm in eyes with cataract, which increased to 2.91 ± 0.34mm after cataract removal, showing a mean difference of 0.53mm which was statistically significant ($p<0.001$). The vitreous chamber depth (VCD) in cataractous eye was 16.16 ± 1.03mm with mean increase in VCD to 17.32 ±0.91mm, showing a difference of 1.15mm in VCD after cataract surgery and PCIOL implantation, which was also clinically significant ($p<0.001$) . As per our study, there was more difference in VCD (1.15mm) compared to ACD (0.53mm) after cataract extraction and PCIOL implantation which also proves that removal of cataract cause changes in both anterior and posterior chambers.[10]

The two main causal mechanisms considered in the pathogenesis of Primary Angle Closure

include pupillary block and nonpupillary block. One of the main parameters that plays a crucial role in occurrence of PACG is the crystalline lens and its thickness (LT) and relative lens position, as seen in various studies.[11]

In a study by Yun-Hsuan Lin et al., patients with acute PACG underwent early or late phacoemulsification with IOL implantation, either alone or after laser peripheral iridotomy (LPI). Both groups showed improvements in visual acuity and anterior chamber depth, and angle width increased in all groups post-procedure. According to H. Zhang et al., lens extraction and IOL implantation, combined with goniosynechialysis or endocyclophotocoagulation, can enhance IOP control in eyes with extensive PAS .[12]

Contrary to the assumption of our study, in one of the studies showed 2 patients developing angle closureafter cataract extraction. 1 patienthad acute rise in IOP rise and closed iridocorneal angle that resolved with laser iridotomy. Another patient came with an insidious course of high IOP and progressive narrowing of theiridocorneal angle.[13,14]

One of the studyshows changes in AS-OCT parameters following phacoemulsification in Pseudoexfoliation eyes. It can explain that cataract extraction is protective against theglaucoma formation, especially in PEX eyes .[15]

LIMITATIONS

The limitations of our study included a smaller number of participants from whom data was collected. A bigger sample size with more eyes with narrower angles is required to understand true association of angle change and cataract surgery. Gonioscopy and Van Herick‘s grading being subjective tests can lead to errors in findings. Assessing the change in IOP could give better association with glaucoma due to narrow angles .

CONCLUSION

The strengths of study are that it is an approach to find the association between cataract surgery and prevention of glaucoma in future. It strengthens the approach of cataract extraction as treatment modality in cases of Angle closure Glaucoma. It also finds the association between ACA and other ocular parameters like ACD, LT and VCD.

Our study proved with significant results that cataract surgery can thus help patients to improvise their vision as well as the shallow AC , which could lead to Angle closure glaucoma .

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