Original Article

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Effect of Phacoemulsification on Intraocular Pressure in Cataract Patients Attending a Tertiary Care Centre in Kerala- A Retrospective Cohort Study

Ophthalmology Section

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ABSTRACT

Introduction: Cataract is the leading cause of preventable blindness worldwide. It is caused by the degeneration and opacification of the lens fibres. Phacoemulsification is the current treatment modality available for cataract. However, there is a possibility of an increase in the anterior chamber depth after phacoemulsification. This occurs as a result of the removal of the bulky lens matter and implantation of a thin intraocular lens, thereby reducing the intraocular pressure.

Aim: To compare the preoperative and postoperative Intraocular Pressure (IOP) changes and the factors associated with intraocular pressure changes among patients who underwent phacoemulsification in a Tertiary Care Centre in Kerala.

Materials and Methods: A retrospective cohort study was carried out among 610 patients, who underwent phacoemulsification surgery from January 1st, 2017 to December 31st, 2017. Using a checklist, the following data such as age, sex, Date of Surgery, Last recorded preoperative intraocular pressure of both eyes, First recorded Postoperative intraocular pressure of both eyes any time after 3 months, Axial length, Grade of cataract and comorbidities like diabetes, hypertension, dyslipidaemia, glaucoma and Coronary Artery Disease (CAD) was obtained from the hospital Information System. Data collected was entered into an MS Excel and was analysed using SPSS version 20. Frequency and percentages were calculated and association assessed using Chi-square test. Paired t-test was applied to find the mean changes in the IOP levels and p-value was ≤0.05, thus significant.

Results: It was observed that there was a mean reduction of 7.907 mmHg in ocular hypertensives when compared to ocular normotensives following phacoemulsification. This finding was found to be statistically significant (p-value <0.001). There was association between grade of cataract and change in IOP which was significant with a p-value of 0.031.

Conclusion: Phacoemulsification is the treatment of choice in patients with cataract. In the study, it was found that ocular hypertensives who underwent phacoemulsification had a significant drop in intraocular pressure post-surgery. Phacoemulsification can be employed in patients who have both ocular hypertension and cataract. This procedure can improve vision and in addition to having a positive effect on IOP reduction.

Keywords: Grade of cataract, Nonglaucomatous patients, Ocular Hypertension, Risk factors

INTRODUCTION

Cataract is the most common cause of treatable blindness across the world in the geriatric population. The lens fibres undergo degeneration and later become opaque. These fibres become disorderly and some other material eventually gets deposited there, subsequent to which the lens loses its transparency [1,2].

Senile cataract usually occurs in the age group 60-70 years, bilateral presentation with one eye being affected earlier than the other. There is no medical management for cataract. However, there are different methods of cataract surgery. Back in the 5th century BC, Sushrutha, the Father of Surgery, introduced an incredible yet extremely painful technique known as the couching technique for the removal of cataractous lens [3]. Following which, the techniques of Intracapsular Cataract Extraction (ICCE) and Extracapsular Cataract Extraction (ECCE) were developed. Over, the period of time, the conventional ECCE evolved into Small incision cataract surgery and Phacoemulsification.

Phacoemulsification was introduced by Charles David Kelman in 1967 and was first met with resistance [4]. However, phacoemulsification is now widely employed and is considered to be safer as compared to many other techniques [5]. It is suture less, with fewer postoperative visits and complications. Moreover, the visual recovery is faster with little limitation of the patient's activities.

However, there is a possibility of an increase in the anterior chamber depth after phacoemulsification. This occurs as a result of the removal of the bulky lens matter and implantation of a thin intraocular lens, thereby reducing the intraocular pressure. Ocular hypertension (defined as intraocular pressure >21 mmHg), is one of the predisposing factors of glaucoma. Glaucoma causes optic nerve head damage with peripheral visual field defects leading to permanent loss of vision. Moreover, neglected senile cataract can predispose to multiple variants of glaucoma like phacomorphic, phacolytic, phaco-anaphylactic glaucoma. If left untreated there will be reduction in the number of sight years [1,2].

Therefore, the objective of the study was to compare the preoperative and postoperative intraocular pressure changes among patients who underwent phacoemulsification in a Tertiary Care Centre in Kerala and to study the factors associated with the intraocular pressure changes.

MATERIALS AND METHODS

The retrospective cohort study was conducted in the Ophthalmology Department of a Tertiary Health Care Centre after obtaining the Institutional Ethical Committee Clearance (IRB-AIMS -2019-234). The sample size was calculated based on a study done by Sambhav K and Sasidharan A in Coimbatore [6]. Therefore, with

95% confidence and 80% power the minimum sample size was calculated to be 117.

Inclusion and Exclusion criteria: The study included all patients who underwent phacoemulsification from January 1st, 2017 to December 31st, 2017 at the tertiary healthcare centre. The patients under study included 314 diabetics, 301 systemic hypertensives, 191 dyslipidemics, 41 patients with established glaucoma and 121 patients diagnosed with CAD. Data of the patient's preoperative and postoperative intraocular pressure any time after three months of surgery were included. While, patients on steroid treatment were excluded since it could alter their intra ocular pressure [7].

A checklist was used to capture all the following data such as Medical Record Department numbers, Age, Sex, Date of Surgery, Last recorded Preoperative intraocular pressure of both eyes, First recorded Postoperative intraocular pressure of both eyes any time after 3 months, Axial length, Grade of cataract and comorbidities like diabetes, hypertension, dyslipidaemia, glaucoma and CAD was obtained from the hospital Information System [2,8]. The grade of cataract among the study population is shown in [Table/Fig-1].

Grade of cataract	Colour	Hardness
I	White/Greenish Yellow	Soft
II	Yellowish	Soft-Medium
III	Amber	Medium-Hard
IV	Brown	Hard
V	Black	Ultra-Hard

[Table/Fig-1]: Grade of Nuclear Cataract (Nuclear Sclerosis-NS) [2].

STATISTICAL ANALYSIS

Data collected was entered into an MS Excel Spreadsheet and was analysed using SPSS version 20. Frequency and percentage was used to summarise categorical variables and association was assessed using Chi-square test. Paired t-test was used to find the mean changes in the IOP levels. Significance level was considered to be ≤0.05

RESULTS

The study consists of a total of 610 participants out of which 51.1% were males. It was observed that majority (83.6%) of them were aged above 60 years. It was observed that majority of the participants had Grade 3 NS (38%) followed by Grade 4 NS (31.6%) type of cataract [Table/Fig-2].

It was observed that there was a mean reduction of 7.907 mmHg in ocular hypertensives when compared to normotensives following phacoemulsification. This finding was found to be statistically significant <0.001 [Table/Fig-3].

The study revealed that out of the many factors, the grade of cataract and change in IOP was found to be statistically significant. Age, gender and other comorbidities were all not found to be statistically significant [Table/Fig-4].

DISCUSSION

The study observed that ocular hypertensives who underwent phacoemulsification had a significant drop in their Intraocular pressure, similar to the findings of a study done by Poley BJ et al., [9]. Also, the grade of cataract was found to be associated with the IOP. The data of 610 patients who underwent phacoemulsification showed that 51.1% were males and 48.9% were females. Also, the mean age of the sample in the study was 67.66±10.196 years. These findings were similar to the study done by Sambhav K and Sasidharan A where the mean age of the patients were 62.13±11.00 years and majority were females (55%) [6].

Characteristics	Frequency	Percentage (%)
Age		
<60 years	100	16.4
≥60 years	510	83.6
Sex		
Male	312	51.1
Female	298	48.9
Operated eye		
Right eye	324	53.1
Left eye	286	46.9
Axial length of eyeball (mm)		
<26	603	98.9
≥26	7	1.1
Grade of cataract		
Grade 0 (Non-Nuclear Variants)*	29	4.8
Grade I NS	27	4.4
Grade II NS	110	18
Grade III NS	232	38
Grade IV NS	193	31.6
Grade V NS	19	3.1
Diabetes mellitus		
Absent	296	48.5
Present	314	51.5
Hypertension		
Absent	309	50.7%
Present	301	49.3%
Dyslipidemia		
Absent	419	68.7%
Present	191	31.3%
Glaucoma		
Absent	569	93.3%
Present	41	6.7%
CAD		
Absent	489	80.2%
Present	121	19.8%
Preoperative IOP (in mmHg)		
Normotensives (<20)	567	92.95%
Ocular hypertensives (>20)	43	7.05%
Postoperative IOP (in mmHg)		
Normotensives (<20)	600	98.4%
Ocular hypertensives (>20)	10	1.6%

[Table/Fig-2]: Baseline characteristics of the study participants (N=610).
CAD: Coronary artery disease; IOP: Intra-ocular pressure; *Cataract without Nuclear Sclerosis but other variants like cortical and cubcapsular cataract

Preoperative IOP in mmHg	Frequency	Mean Change in IOP postoperative in mmHg	p-value
<20	567	0.8042	**<0.001***
>20	43	7.907	

[Table/Fig-3]: Mean reduction of IOP among normotensives and ocular hypertensives after phacoemulsification.
p≤0.05 is statistically significant, *Paired t-test was used to derive this conclusion;
IOP: Intra-ocular pressure

In this study, the sample was categorised based on the axial length of the eyeball (26 mm), however no significant association was found between axial length of eyeball and change in intraocular pressure post-phacoemulsification [10]. The findings were similar to the study conducted by Bhallil S et al., [11]. Other studies conducted by Anazi NM et al., and Charoenchitrwattana U showed a decrease in IOP with moderate and long axial lengths [12,13].

Variables studied	Increased IOP	Decreased IOP	Total	p-value
Age				
Age >60 years	138 (27.1%)	372 (72.9%)	510	0.527
Age <60 years	24 (24%)	76 (76%)	100	
Sex				
Females	74 (24.8%)	224 (75.2%)	298	0.346
Males	88 (28.2%)	224 (71.8%)	312	
Grade of cataract				
Grade 0 Non: Nuclear Variants)***	7 (24.1%)	22 (75.9%)	29	**0.031**
Grade I-III (NS)	85 (23%)	284 (77%)	369	
Grade IV-V (NS)	70 (33%)	142 (67%)	212	
Axial Length (mm)				
Less than 26	160 (26.5%)	443 (73.5%)	603	0.594
Greater than 26	2 (28.6%)	5 (71.4%)	7	
Diabetes mellitus				
Absent	68 (23%)	228 (77%)	296	0.052
Present	94 (29.9%)	220 (70.1%)	314	
Hypertension				
Absent	83 (26.9%)	226 (73.1%)	309	0.863
Present	79 (76.2%)	222 (73.8%)	301	
Dyslipidaemia				
Absent	111 (26.5%)	308 (73.5%)	419	0.957
Present	51 (26.7%)	140 (73.3%)	191	
Glaucoma				
Absent	154 (27.1%)	415 (72.9%)	569	0.290
Present	8 (19.5%)	33 (80.55%)	41	
CAD				
Absent	122 (24.9%)	367 (75.1%)	489	0.071
Present	40 (33.1%)	81 (66.9%)	121	
Co-morbidities**				
Absent	41 (25.6%)	119 (74.4%)	160	0.421
Present	121 (26.9%)	329 (73.1%)	450	

[Table/Fig-4]: Association between different variables and change in IOP. *Chi-square test was used, significance level ≤0.05; **Co-morbidities include: Diabetes mellitus, hypertension and dyslipidaemia; IOP: Intra-ocular pressure; CAD: Coronary artery disease; ***Cataract without nuclear sclerosis but other variants like cortical and subcapsular cataract

In the study, the mean preoperative IOP was 15.82 mmHg similar to Sambhav K and Sasidharan A which was 14.17±3.47 mmHg and Al Anazi NM et al., which was 14.12 mmHg. The mean postoperative IOP in the study was 14.52 mmHg and in Sambhav K and Sasidharan A was 13.24±3.66 mmHg and in Al Anazi NM et al., was 13.5 mmHg. The mean reduction in IOP after phacoemulsification in this study was 1.305±3.571 mmHg compared to Sambhav K and Sasidharan A and Al Anazi NM et al., where it was 0.93 and 0.6 mmHg, respectively [6,12].

A significant association was observed between the grade of cataract and change in IOP with a p-value of 0.031. However, such association has not been observed in a similar study done by Dhamankar R et al., [14].

Some previous studies showed that there was a considerable decrease (mean reduction=0.6) in IOP post-phacoemulsification among those patients who had a high pre-operative IOP [12,15-18]. This study also showed similar findings, with significant decrease in IOP (mean reduction=7.907mmHg) among ocular hypertensives post-phacoemulsification, compared to their normotensive counterparts.

There was no significant association between age, sex, diabetes mellitus, hypertension, dyslipidemia, CAD and change in IOP after phacoemulsification. The findings corroborate with those of Coban-Karatas M et al., and Bhallil S et al., [10,11].

In patients with both glaucoma and cataract, phacoemulsification can be carried out first since it will improve sight and also result in reduction in intraocular pressure, rather than opting for combined trabeculectomy and phacoemulsification.

Limitation(s)

The study had incomplete patient records. The study could not find the change in intraocular pressure with anterior chamber depth and pressure depth ratio as these variables were not documented pre-operatively. Pre-operative gonioscopy was not done so as to classify the patients as angle closure glaucoma or open angle glaucoma.

CONCLUSION(S)

Phacoemulsification is the treatment of choice in patients with cataract. In this study, it was found that ocular hypertensives who underwent phacoemulsification had a significant drop in intra ocular pressure post-surgery. Phacoemulsification can be employed in patients who have both ocular hypertension and cataract. This procedure can improve vision and in addition to having a positive effect on IOP reduction. This translates to reduced cost, number of surgical interventions and overall reduced financial burden on the patient.

REFERENCES

[1] Sihota. Parsons's Diseases of the Eye. (22 ed.): Elsevier; 2015.
[2] Khurana AK K. Review of Ophthalmology. 7th ed. Jaypee Brothers Medical Publisher (P) Ltd.,: Jaypee; 2015.
[3] Kansupada KB, Sassani JW. Sushruta: The Father of Indian Surgery and Ophthalmology. Documenta Ophthalmologica. [Online] 1997;93(1):159-67.
[4] Davis G. The evolution of cataract surgery. Mo Med. 2016;113(1):58-62.
[5] Ali IK, Kamal H, Mustafa A. Causes of poor visual outcome of extracapsular cataract extraction with posterior chamber intraocular lens implantation. Sudanese Journal of Ophthalmology. 2014;6(2):54-56.
[6] Sambhav K, Sasidharan A. Analysis of change in intraocular pressure after phacoemulsification. Sudanese Journal of Ophthalmology. [Online] 2013;5(1):07-08.
[7] Phulke S, Kaushik S, Kaur S, Pandav SS. Steroid-induced glaucoma: An avoidable irreversible blindness. Journal of Current Glaucoma Practice. [Online] 2017;11(2):67-72.
[8] Cassette S, Blomme N. Classification of Myopia-Doctor Damien Gatinel. https://www.gatinel.com/en/recherche-formation/myopie-definition-mecanismes-epidemiologie-facteurs-de-risques/classification-de-la-myopie/. Accessed 27 Aug. 2019.
[9] Poley BJ, Lindstom RL, Samuelson TW, Schulze R Jr. Intraocular pressure reduction after phacoemulsification with intraocular lens implantation in glaucomatous and non-glaucomatous eyes: Evaluation of a causal relationship between the natural lens and open-angle glaucoma. Journal of Cataract and Refractive Surgery. [Online] 2009;35(11):1946-55.
[10] Coban-Karatas M, Sizmaz S, Altan-Yaycioglu R, Canan H, Akova YA. Risk factors for intraocular pressure rise following phacoemulsification. Indian J Ophthalmol. 2013;61(3):115-18.
[11] Bhallil S, Andalloussi IB, Chraibi F, Daoudi K, Tahri H. Changes in intraocular pressure after clear corneal phacoemulsification in normal patients. Oman Journal of Ophthalmology. [Online] 2009;2(3):11-113. Available from: http://www.ojoonline.org/article.asp?issn=0974-620X;year=2009;volume=2;issue=3;spage=111;epage=113;aulast=Bhallil.
[12] Al Anazi NM, Musallam NA, Priscilla Gikandi PW, Mousa A, Al Muammar AM, Osman EA. Impact of axial length and preoperative intraocular pressure on postoperative intraocular pressure changes in nonglaucomatous eyes following phacoemulsification surgery in a university hospital. Austin J Public Health Epidemiol. 2016;3(2):1036.
[13] Charoenchitrwattana U. The effect of phacoemulsification on intra ocular pressure in glaucoma with cataract patient, ocurring in one of the hospitals under medical service department, Bangkok metropolitan administration. Vajira Medical Journal: Journal of Urban Medicine. [Online] 2018;62(5):357-64.
[14] Dhamankar R, Chandak N, Haldipurkar S, Haldipurkar T. Factors affecting changes in the intraocular pressure after phacoemulsification surgery. Int Eye Sci. 2018;18(12):2125-31.
[15] Shingleton Bradford, Wadhwani Resham, O'Donoghue Mark, Baylus Susan, Hoey Helen. Evaluation of intraocular pressure in the immediate postoperative period after phacoemulsification. J Cataract Refract Surg. 2007;27(11):524-27.
[16] Baek SU, Kwon S, Park IW, Suh W. Effect of Phacoemulsification on Intraocular Pressure in Healthy Subjects and Glaucoma Patients. J Korean Med Sci. 2019;34(6):e47.

[17] Ramakrishnan R, Shrivastava S, Narayanam S, Dudhat B, Bhalla N. Effects of cataract surgery on ocular hypertension. Kerala Journal of Ophthalmology. [Online] 2016;28(3):186.

[18] Zamani M, Feghhi M, Azarkish A. Early changes in intraocular pressure following phacoemulsification. Journal of Ophthalmic and Vision Research. [Online] 2013;8(1): 25-31.

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