Original Research Article

Correlation between phacoemulsification effective time and anterior chamber depth in uncomplicated cataract surgery

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Abstract

Purpose: This manuscript reports the study to find if there was a correlation between phacoemulsification effective time and anterior chamber depth in uncomplicated cataract surgery. **Methods**. This was a single-center prospective observational study conducted in cataract surgeries done between January 2021 and July 2021 in which patients were grouped according to preoperative anterior chamber depth. The outcome measures included total ultrasound time for phacoemulsification in cataract surgeries. **Results**: We analyzed 69 patients by noting the ultrasound time as above. It was seen that there is statistically significant inverse correlation of anterior chamber depth to phacoemulsification ultrasound time. 22 patients (32%) had average ACD 3 mm and the phaco time was less than one minute in this group. 40 patients (58%) had mean ACD 2.88 mm and phaco time was between 1 to 2 min in this group. 7 patients (10%) had mean ACD 2.54 mm and phaco time was between 2 to 3 min in this group which was higher than previous two groups. **Conclusions:** Shallower ACD is associated with progressively higher ultrasound time for phacoemulsification. Measuring ACD provides a simple yet effective tool at the hands of the surgeon to gauge the extent of difficulty in cataract surgery.

Keywords: Ultrasound time, phacoemulsification, anterior chamber depth

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INTRODUCTION

Shallow anterior chamber depth is associated with difficulty in maneuvering phaco probe safely to reach the cataract during phacoemulsification while at the same time, the surgeon has to be cautious as to avoid damage to the endothelium by either the phaco probe or the second instrument viz chopper/dialler.[1,2] Phacoemulsification is fraught with many challenges, one of them being dealing with the peculiar anatomy of a small anterior chamber depth. An objective assessment and grading the level of severity of difficulty can be measured by the amount of time needed to complete phacoemulsification.

METHODS

Institutional review board approval was obtained from the Research Committee of the teaching hospital and Approval of ethics committee was taken. Written informed consent was obtained from all the participants. Patients were recruited from the Ophthalmology OPD of our teaching hospital between Jan 2021 to June 2021. All the patients possessed visually significant cataracts and had best-corrected visual acuity of less than 6/18 in the affected eye. Patients with age related cataract planning to undergo Phacoemulsification were included in the study. This was a prospective observational study.

Patients were grouped according to preoperative anterior chamber depth. The grade of nuclear sclerosis and lens thickness, age, sex distribution were noted and consent for study was taken from patients. The exclusion criteria included ocular comorbidities such as previous penetrating

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surgery, complications related to the cataract surgery (such as posterior capsular rupture and vitreous loss, primary or secondary glaucoma, and peripheral anterior synechiae), glaucomatous optic neuropathy. Methodology included detailed preoperative history, written informed consent, measurement of Intra Ocular Pressure (IOP) using Goldmann applanation tonometer, measurement of Anterior chamber depth (ACD) by A-scan biometry making use of the single machine and slit lamp bio-microscopy after pupillary dilation.

Echorule 2: Biomedix A scan machine with Immersion non-contact mode biometry was done for measuring Central ACD. The mean of 10 readings with SD < 0.1 was taken. The other preoperative workup required for cataract surgery by phacoemulsification included measurement of Blood pressure, fasting and post prandial Blood sugar, K-reading, calculation of IOL power, pre-anesthetic check-up. A standard Phacoemulsification surgery was performed by an experienced surgeon making use of the same kind of microscope and Phaco machine. Phacoemulsification ultrasound time US 1 US 2 and Total US time were noted during surgery. All the operations were performed by the same surgeon using conventional surgical procedures. In brief, eyes were prepared for surgery by instilling tropicamide, 0.5%, and phenylephrine hydrochloride, 10%, for pupil dilation, and lignocaine hydrochloride 2.0% 5ml for peribulbar anesthesia. All the surgical procedures were undertaken using a 2.8-mm superior clear corneal tunnel incision. After the incision, the continuous curvilinear capsulorrhexis measuring approximately 6 mm in diameter was performed using a cystitome. Hydrodissection, in-the-bag phacoemulsification using the stop and chop technique, cortical aspiration, and insertion of a foldable acrylic IOL in the capsular bag were performed step by step. Observation tables were made and statistical analysis of results was done. All the data were reported as mean (SD) ACD and total ultrasound time. Differences between ultrasound time for phacoemulsification in the groups with different ACD were analyzed and compared using the paired t test. P < .001 was considered statistically significant. Data analysis was conducted using MS EXCEL 2016 software.

RESULTS

69 patients were in nuclear grade 3 cataract category. There was statistically significant inverse correlation PEARSON coefficient -0.55 at p< 0.0001 level. However, patients in nuclear sclerosis category grade 1 (n=52) PEARSON coefficient -0.095 at p< 0.001 level and grade 2 (n=58) PEARSON coefficient -0.08 at p< 0.001 showed no such correlation. The explanation for this difference is probably due to the relative ease of emulsifying softer grades of cataract. There were 5 patients with grade 4 nuclear sclerosis hard cataract in this sample population. To eliminate the confounding influence of excessive hardness of cataract on total phacoemulsification time, these patients were excluded from the study. TABLE 4 We analyzed 69 patients of grade 3 nuclear sclerosis category by noting the ultrasound time as above. It was seen that there is statistically significant inverse correlation of anterior chamber depth to phacoemulsification ultrasound time. Table 1 shows that 22 patients (32%) had average (SD) ACD 3.12 (0.4) mm and the phaco time was less than one minute in this group. 40 patients (58%) had mean ACD 2.88 (0.5) mm and phaco time was between 1 to 2 min in this group.[7] patients (10%) had mean ACD 2.54 (0.4) mm and phaco time was between 2 to 3 min in this group which was higher than previous two groups. Table 2 and 3 show the correlation between ultrasound time for phacoemulsification and ACD.

Table 1:

total phaco time	n	ACD in mm (mean)
phaco time less than 1 min	22	3
phaco time 1 to 2 min	40	2.88
phaco time 2 to 3 min	7	2.54
Total	**69**	

Table 2

Variables in pts	N	Mean	variance	Paired T Test	P-Value	Sig. at 5% level
Ant chamber depth	69	2.92	0.21	-19.729**	<0.001	Yes
Ultrasound time	69	78.5	996.7			

** Statistically highly significant at 0.1% level i.e.P<0.001

Table 3

t-Test: Paired Two Sample for Means		
	Variable 1	***Variable 2***
Mean	2.926666667	78.52028986
Variance	0.210172549	996.7872293
Observations	69	69
Pearson Correlation	-0.550182793	
Hypothesized Mean Difference	0	
Df	68	
t Stat	-19.7297	
P(T<=t) one-tail	0.0000	
t Critical one-tail	1.6676	
P(T<=t) two-tail	0.0000	
t Critical two-tail	1.9955	

Table 4

Category	n
Gr 1 NS	52
Gr 2 NS	58
Gr 3 NS	69
Gr 4 NS	5

DISCUSSION

To be forewarned **is** forearmed. This dictum also applies to surgery. Generally speaking, the grade of cataract is taken into consideration while planning phacoemulsification surgery. The hardness of cataract is an important deciding factor to adjust phaco parameters at start of the surgery.[4] Equally important factor is anterior chamber depth in phacoemulsification surgery. This aspect of planning has been proven to be crucial in the present study. Postoperative Complications resulting due to shallowness of anterior chamber are corneal edema.[3] Intraoperative complications such as Descemet's detachment and iris prolapse are more frequently seen in such patients. There is also a higher incidence of glaucoma.[5] Measuring ACD provides a simple yet effective tool at the hands of the surgeon to gauge the extent of difficulty in cataract surgery. Such a study creates the groundwork for a larger study taking into consideration such and all other parameters to create an objective scoring system for grading of problems in cataract surgery. The results of this study show that phaco time is inversely related to ACD. Probably, a further implication of this study is that a regular assessment of ACD would be beneficial to note as an indicator of increased phaco time. As the amount of phaco time directly affects the endothelial cell loss adequate measures for endothelial protection can be thus taken in the light of this knowledge. Other benefits of measuring ACD are also worthwhile in cataract surgeries, such as reduction of IOP in narrow angle glaucoma after cataract operation wherein shallow ACD is also seen. Evaluation of preoperative and intraoperative parameters affecting total and localized endothelial cell loss after phacoemulsification surgery is important in assessment for cataract surgery. One study done in Indonesia by Budiman showed similar correlation between ultrasound time for phacoemulsification and ACD.[6] Studies done by Upasana et .al and many other studies have primarily focused on endothelial cell loss as outcome measure related to ACD in phacoemulsification as the postoperative complication and in most studies, we found correlation between ECL and shallowness of ACD.[7] However, none of the studies have compared the total ultrasound time taken to ACD. This we think is the uniqueness of our study. Such a comparison of this outcome measure also correlates well with previous studies indicating a similar conclusion drawing attention to intra operative problems during phacoemulsification.

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