Phacoemulsification For Various Grades of Cataract: A Critical Evaluation By Peristaltic Versus Venturi

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Abstract

Objective: *The purpose of this study was to evaluate the phacoemulsification for various grades of cataract by Peristaltic versus Venturi.*

Methods: *This was a comparative longitudinal study. The study included 112 patients with cataract who underwent cataract extraction by Phacoemulsification by peristaltic pump (Group I) and by Venturi pump (Group II). Group I consisted of 53 patients and Group II consisted of 59 patients. Postoperatively patients were given antibiotic, steroid and mydriatic drops for 6 weeks. Second day, 1 week, 6 weeks, 3 months, 6 months and 1 year follow up was done with postoperative examination which included visual acuity assessment, slit lamp biomicroscopy, tonometry keratometry, direct ophthalmoscopy to see media clartity. The post-operative data was collected at the end of study i.e. at 1 year.*

Results: *Majority of the patients of the both Group I (77.4%) and Group II (81.4%) had cortical cataract. The nuclear hardness of grade 3+ was among more than one third of the patients in both Group I (47.2%) and Group II (45.8%). There was no significant difference in the pre-operative parameters between the groups. There was significant difference (p<0.05) in effective phaco time in both the groups. There was significant difference (p<0.05) in effective phaco time in both the groups. There was no significant (p>0.05) difference in intra and post-operative complications between the groups.*

Conclusion: *The venturi pump was found to be better than peristaltic pump, however, there was no significant difference between the groups in terms of the outcome assessment.*

Key words: *Phacoemulsification, Cataract, Peristaltic, Venturi*

INTRODUCTION

Cataract is a common vision-threatening condition that accounts for approximately 40% to 50% of global blindness; as such, an estimated 20 million cataract surgical procedures are performed worldwide each year.[1,2] Clinicians prefer ultrasonic phacoemulsification of the crystalline lens because this approach has a low incidence of complications and better uncorrected visual outcomes than alternative treatment options for cataract removal.[2-5] Phacoemulsification is performed using a phacoemulsifier aspirator (PEA). Most PEA systems use peristaltic pump technology that allows for independent control of both the aspiration flow rate and vacuum limit and can facilitate markedly lower flow rates than those with nonperistaltic (ie, venturi) systems.

Cool phacoemulsification is an effective and safe technique to manage all types of cataract.[6] During traditional phacoemulsification the probe operates at a frequency of 40000 Hz while in the burst or micropulse sonic mode it operates at 400 Hz.[7] The potential advantages of this technique are the reduction of total ultrasound power to anterior segment leading to less surgical tissue damage and less postoperative corneal edema.[8-9]

During normal surgical conditions (ie, when the phacoemulsification tip is not occluded), the vacuum level in the system's fluidics is relatively low. When the tip becomes occluded with aspirated material during surgery, the vacuum in the system builds to a preset vacuum limit, which triggers a vacuum pump shut-off. When an occlusion break occurs, the vacuum accumulated in the aspiration lines returns to the original low

level. In many systems, particularly older systems, a secondary effect referred to as occlusion break surge can occur.

The purpose of this study was to evaluate the phacoemulsification for various grades of cataract by Peristaltic versus Venturi.

MATERIAL AND METHODS

Study design and subjects

This was a comparative longitudinal study carried out in the Upgraded Department of Ophthalmology, S.V.B.P. Hospital, L.L.R.M. Medical College, Meerut from September 2003 to August 2004. The study was approved by the Ethical committee of the College. The consent was taken from all the patients before enrolling in the study. The study included 112 patients with cataract who underwent cataract extraction by Phacoemulsification by peristaltic pump (Group I) and by Venturi pump (Group II). Group I consisted of 53 patients and Group II consisted of 59 patients.

Methods

The one eyed patients, patients with sub-luxated lens, uveitis, corneal dystrophies & opacities, shallow AC, miotic pupil, miotic pupil, pre-existing ocular surgery and diabetic/hypertensive patientswere excluded from the study. A standard protocol was used for preoperative examination, which included complete ocular examination, including record of visual acuity, macular function tests, tonometry, keratometry, slit lamp examination before and after dilatation of the pupil especially for any corneal pathology

&gonioscopy if indicated, dilated direct ophthalmoscopy, meticulous detailed history along with systemic examination &investigations as and when required.Pre-operatively antibiotic, mydriatic and NSAID eye drops were prescribed. All the measures for complete sterilization were taken.Peribulbar block was given with a mixture of lignocaine 2% and Bupivacaine 0.5% in a ratio of 3:1 adrenalin 1/100,000 parts and hyaluronidase 1500 IU/80 ml of anaesthetic solution.

Postoperative Data

Postoperatively patients were given antibiotic, steroid and mydriatic drops for 6 weeks. Second day, 1 week, 6 weeks, 3 months, 6 months and 1 year follow up was done with postoperative examination which included visual acuity assessment, slit lamp biomicroscopy, tonometry keratometry, direct ophthalmoscopy to see media clartity. The post-operative data was collected at the end of study i.e. at 1 year.

Analysis

The results are presented in percentages. The Chi-square test was used to compare the categorical/dichotomous variables between the groups. The p-value <0.05 was set for statistical significance. All the analysis was carried out by using SPSS 16.0 version (Chicago, Inc., USA).

RESULTS

About half of the patients of Group I (49.1%) and 50.8% of Group II was between 55-65 years of age. More than half of the both Group I (52.8%)

and Group II (54.2%) patients were males. No statistically significant difference (p>0.05) was found in age & sex distribution of both the groups. Right eye was operated in 52.8% patients in Group I and 49.2% patients in Group II, while 47.2% patients in Group I and 50.5% patients in Group II, left eye was operated. Majority of the patients of the both Group I (77.4%) and Group II (81.4%) had cortical cataract. The nuclear hardness of grade 3+ was among more than one third of the patients in both Group I (47.2%) and Group II (45.8%). However, nuclear hardness of grade 2+ was observed in 20.7% patients of Group I and in 22% patients of Group II. The 6/60 or lesser pre-operative visual acuity was among majority of the patients of both Group I (71.7%) and Group II (69.5%). There was no significant difference in the pre-operative parameters between the groups (Table-1).

There was significant difference (p<0.05) in effective phaco time in both the groups (Fig.1).

Table-2 shows the comparison of intra and post-operative complications between the groups. The most common intra-operative complication in Group I (9.4%) and Group II (5.1%) was fluctuating AC depth. However, the difference was statistically not significant (p>0.05). Intra-operatively, the incomplete trench was observed in 7.5% of the patients of Group I and in 3.4% patients of Group II, however, the difference was statistically not significant (p>0.05). Post-operatively, corneal edema was found in 7.5% of Group I and in 3.4% of Group II. There was no significant (p>0.05) difference in intra and post-operative complications between the groups.

Table-1: Baseline characteristics of the patients

	Group I (n=53)		Group II (n=59)		p-value[1]
	No.	**%**	**No.**	**%**	
Age in years					
<45	8	15.1	8	13.6	0.99
46-55	12	22.6	13	22.0	
55-65	26	49.1	30	50.8	
>65	7	13.2	8	13.6	
Gender					
Male	28	52.8	32	54.2	0.88
Female	25	47.2	27	45.8	
Eye					
Right	28	52.8	29	49.2	0.69
Left	25	47.2	30	50.8	
Type of cataract					
Cortical	41	77.4	48	81.4	0.60
Nuclear	12	22.6	11	18.6	
Grades of nuclear hardness					
1+	8	15.1	8	13.6	0.98
2+	11	20.7	13	22.0	
3+	25	47.2	27	45.8	
4+	9	17.0	11	18.6	
Visual acuity					
6/6-6/9	0	0.0	0	0.0	0.96
6/12-6/18	4	7.5	5	8.5	
6/24-6/36	11	20.8	13	22.0	
6/60 or lesser	38	71.7	41	69.5	

[1]Chi-square test

Table-2: Comparison of Intra and post-operative complications between the groups

| Complications	Group I (n=53)		Group II (n=59)		p-value[1]
	No.	**%**	**No.**	**%**	
Intra-operative					
Incomplete trench	4	7.5	2	3.4	0.21
Fluctuating AC depth	5	9.4	3	5.1	0.37
Corneal burn	3	5.7	2	3.4	0.56
Small segment floating	3	5.7	1	1.7	0.26
Residual cortex	3	5.7	2	3.4	0.56
PC rent	1	1.9	2	3.4	0.62
Vitreous loss	0	-	1	1.7	NA
Nucleus drop	0	-	0	-	NA
Post-operative					
Wound leak	2	3.8	-	-	NA
Iris prolapsed	-	-	-	-	NA
Corneal edema	4	7.5	2	3.4	0.21
Iritis	1	1.9	2	3.4	0.62
CME	2	3.8	3	5.1	0.74

[1]Chi-square test
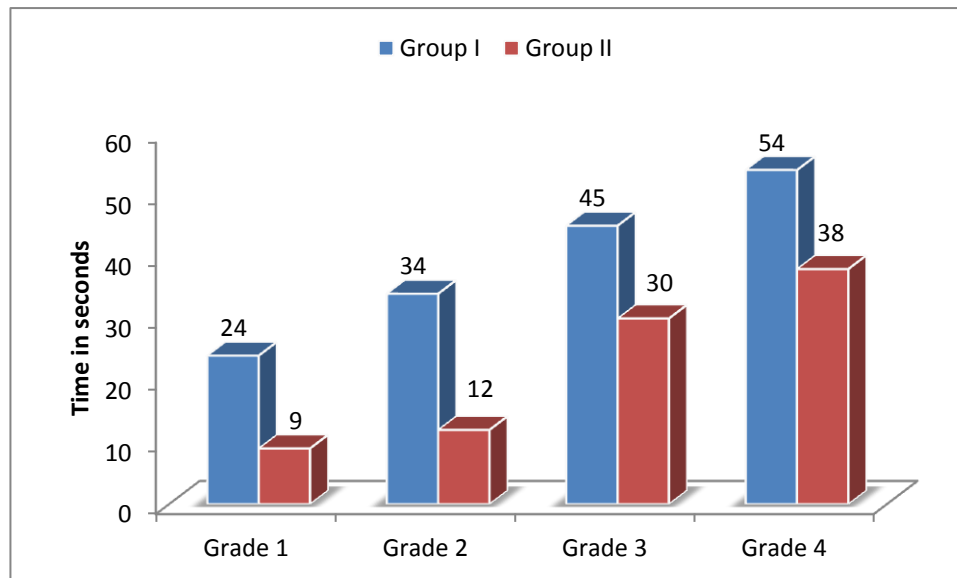
Fig.1: Comparison of Effective phaco time (in second)

DISCUSSION

Ultrasound phacoemulsification technologies have evolved over the last several years to improve surgical efficacy and postsurgical outcome and to reduce complications of cataract surgery.[10] We studied 112 patients with cataract who underwent cataract extraction by Phacoemulsification by peristaltic pump (Group I) and by Venturi pump (Group II). Group I consisted of 53 patients and Group II consisted of 59 patients.

In Group I, 49.1% of patients were in age group of 55 -65 years and in Group II, 50.8% of patients were in age group of 55-65 years in the present study. The cataract has been reported to be more common above the age of 50 years and the incidence increases with age.[11]

Cataract occurs equally in both sexes above the age of 50 years and it shows slightly female preponderance below 50 years of age.[12] Similar observation was found in the present study also.

In the present study, 41 (77.4%) patients had cortical cataract and 14 (26.4%) patients had nuclear cataract in Group I. Similarly, 48 (81.4%) patients had cortical cataract and 11(18.6%) patients had nuclear cataract in Group II. This incidence is similar to one reported by Wolfe et al[13] i.e. above 75% have cortical cataract & less than 25% have nuclear cataract.

In the present study, after all four quadrants of endonucleus removal andepinucleus removal, the residual cortical matter andviscoelastics removed with I/A mode. In Group I, lens matter was removed with I/A mode with 500 mmHg of vacuum, while in Group II during I/A mode vacuum was set at 350 mmHg.

In our study, the effective phaco time (total phaco time at 100% phaco power) was compared in both the groups. In Grade I cataract in Group I, it was 24 sec. and in Group II, it was 9sec. In grade 2 cataract EPT was 34 sec in Group I and was 12 sec in Group II. EPT was 45 sec in Group I in

grade 3 cataract & 30 sec in Group II in grade 3 cataracts. In EPT was 54 sec in grade 4 cataract & was 38 sec in Group II patients. So, EPT was significantly less (p<0.05) in Group II patients than in Group I patients. Endothelial damage or cell loss is definitely more in cases where phaco time is more.

Fine et al[9] described how the Sovereign phaco system provides customizable options and allows to complete phaco with less power to the eye. In six cases, they has used less than 1 second of phaco time. The control protects the capsular bag.Transient corneal edema was seen in 4 (7.5%) in Group I patient and in 2 (3.4%) patient in Group II. Phacoemulsification is a highly dynamic and viscoelastic dependent procedure. Corneal edema was observed more in peristaltic group because more power was used in this group and effective phaco time was more. Endothelial damage or cell loss is definitely more when phaco time is more. Kraff et al[14] in a series of 650 patients found 2.3% of patients has transient striate keratopathy.Cystoid macular edema was seen in 2(3.8%) in Group I & in 3(5.1%) in Group II in the present study.

One of the limitations of the present study was fewer sample size with short study period. Further studies are recommended to comment on the efficacy of the two systems.

CONCLUSION

The venturi pump was found to be better than peristaltic pump, however, there was no significant difference between the groups in terms of the outcome assessment.

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