

Outcome of dual infusion through irrigating chopper in conventional phacoemulsification

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Abstract

Objective: To determine the operative advantage in terms of minimizing the complications following conventional phaco surgery with dual infusion through irrigating chopper.

Methods: A Randomized Controlled Clinical Trial (RCCT) was conducted in the Ophthalmology Unit-III, Sindh Government Lyari General Hospital and DUHS and Al-Noor Eye Hospital Karachi, from March 2008 to February 2009.

A total of 200 eyes with nuclear/cortico-nuclear cataract on Lens Opacity Classification System III underwent phacoemulsification. In all 100 eyes in group A were randomized to have conventional phacoemulsification with dual infusion technique through irrigating chopper and another 100 eyes in group B by conventional phaco surgery. Outcomes in two groups were judged by amount of Ringer's Lactate used, stability of anterior chamber and number of complications observed.

Results: Rate of intra-operative complications was lower in group A as compared to group B ($p=0.002$). Anterior chamber depth was maintained in all cases of group A while it collapsed in 9 cases of group B which was highly significant ($p=0.003$). Mean amount of Ringer's Lactate used in group A was 260.2 ± 55.07 ml and 195.8 ± 35.0 ml in group B, which was significantly high ($p<0.001$).

Conclusion: Dual infusion through irrigating chopper serves triple function of irrigation, chopping and additional separate distant infusion. It improves anterior chamber stability and compensates surge and operative advantage to surgeon.

Keywords: Dual infusion, irrigating chopper, stability of anterior chamber and amount of Ringer's Lactate (JPMA 61:145; 2011).

Introduction

Successful cataract surgery is determined in terms of quicker and safer visual and functional recovery, which is closely related to the size of the wound.¹ Visual outcome continues to improve as small incision surgery evolves, with phacoemulsification emerging as the most popular technique.² Towards this end, micro incision cataract surgery (MICS) is now becoming popular,³ which requires "naked" phaco needle without irrigating sleeve. This leads to increased wound burn, which is addressed by "cold" phacoemulsification.⁴ Alternate small incision techniques introduced from time to time which include constricting wire loop technique by Keener,⁵ phacosandwich technique of Fry,⁶ and phacosection technique proposed by Peter Kansas,⁷ could not draw more attention from cataract surgeons. Kratz⁸ has revolutionized the non-phaco manual small incision cataract surgery (MSICS) by introducing sclerocorneal pocket tunnel incision.

Phaco surgery is done in "closed" chamber. In traditional phacoemulsification, sometimes there is a shallow anterior chamber and wound burn. If wound leaks either from main incision or from side ports, anterior chamber collapses,

while in a tight wound there is a danger of corneal burn. In hard nucleus, sometimes the surgeon keeps the wound leaking to avoid incision burn but this leads to a shallow chamber.

Various methods were employed to maintain adequate anterior chamber depth and still few are under trial. Ophthalmic viscosurgical devices (OVDs) are frequently used to maintain anterior chamber depth as well as coating of corneal endothelial surface thus protecting endothelium during cataract surgery.⁹ Conversely, some OVDs increase thermal damage causing endothelial cell loss.¹⁰ OVDs may also cause increase in intraocular pressure (IOP) and inflammation in the immediate postoperative period, which may cause further endothelial cell loss.¹¹

Attempts were made to maintain anterior chamber depth by adjusting height of irrigating bottle. Using Benchmol's high infusion technique with different bottle heights, the surgeon can control the infusion and ultimately very deep stable anterior chamber is maintained. Due to high pressure, good viscoelastic is required to avoid endothelial damage and iris prolapse. In 1987, the novel innovation of anterior chamber maintainer (ACM) by Blumenthal¹² has permitted a high pressure and high flow system, providing a

physiological environment throughout the surgery. The ACM is a hollow steel tube with a 0.9 mm outer diameter and 0.65mm inner diameter.¹³

Using irrigating chopper in traditional phaco has added a very good tool to overcome the collapse of anterior chamber without insulting ocular tissues by extra ports. Here the additional infusion flows through irrigating chopper. In this dual infusion phaco technique, distant irrigation flow directs the nuclear fragments to phaco tip. This infusion also pushes the posterior capsule away and creates a space for maneuverability. Dual infusion by irrigating chopper prevents anterior chamber collapse and thereby prevents endothelial damage.

To the best of our knowledge, there is no such clinical trial of conventional phaco with dual infusion available in Pakistan. The purpose of this study is to determine the effects in terms of minimizing the complications following conventional phaco surgery with dual infusion through irrigating chopper.

Patients and Methods

This prospective randomized clinical control trial included 200 eyes of 190 patients, which were subjected to phacoemulsification surgery for cataract between March 2008 and February 2009, at Ophthalmology unit III, Sindh Government Lyari General Hospital, Dow University of Health Sciences and Al-Noor Eye Hospital Karachi.

Comprehensive data of each patient was recorded and written consent obtained after explaining surgical procedure and possible results and consequences. Patients were selected from either gender of age between 40 to 75 years having nuclear/cortico-nuclear cataract of grade II to IV according to Lens Opacity Classification System (LOCS) III.¹⁴ Patients were randomly divided into two groups comprising 100 eyes in each group. Patients in group A underwent conventional phaco with dual infusion technique while group B patients underwent conventional phaco technique. Patients with myopia up to -6.0 D and hypermetropia up to +5.0 D were also included in the study. Patients having corneal and vitreo-retinal pathology, glaucoma, traumatic cataract, cataract with posterior synechiae and eyes with previous intraocular surgery were excluded from the study.

The principal author performed all cataract extractions by conventional phacoemulsification with 3.2 mm sclero-corneal incision between 11'O clock position and side port with 150 knives at 2'O clock position. The anterior chamber was filled with visco elastic methylcellulose and continuous curvilinear capsulorrhexis was followed by hydro-dissection and hydro-delineation. Only amendment made in conventional phaco in group A was an irrigating chopper connected with extra infusion of Ringer's lactate

through side port. Continuous phaco mode were set in all cases with bottle height of 60 cm, vacuum at phaco stage I was between 30 to 50 mmHg and between 300 to 350 mmHg at phaco stage II. Effective phaco time (EPT) was maintained between 30 to 200 seconds.

All surgical events were noted carefully and subsequent amendments made to meet efficient results. Follow up examination was strictly monitored.

Data were analyzed by SPSS version 15.0. All continuous response variables like quantity of Ringer's lactate were presented by mean $\pm$ SD and student's t-test was applied. Qualitative response variables like age groups, cataract grading, and intra-operative and post-operative complications were presented by frequencies and compared through chi-square test between two groups. If p-value was $\leq$ 0.05, then the difference was considered significant.

Results

Out of 100 eyes, in group A, there were more males (56%) than females (44%). Similarly in group B, males were 51% and females were 49%. The age range was from 40 years to 75 years. The commonest age group in group A and B was between 51 to 60 years. According to Lens Opacities Classification System III, 54 patients had grade II, 32 had grade III and rest of 14 patients had grade IV cataract in group A while in group B 48 patients had grade II cataract, 29 had grade III cataract and 23 patients had grade IV cataract. There were 28 myopic eyes in group A and 24 eyes in group B while 16 eyes were hypermetropic in group A whereas only 19 had hypermetropia in group B. There were no significant differences in various demographic data between both groups (Table-1).

Rate of intra-operative complications were lower in group A as compared to group B. Capsulorrhexis extended in 2 cases in group A and in 3 cases of group B. Anterior

Table-1: Demographic data.

	Group A (n=100)	Group B (n=100)	p-value
Male	56	51	0.571
Female	44	49	
Age between			0.893
♦ 40-50 years	23	26	
♦ 51-60 years	49	44	
♦ 61-70 years	25	26	
♦ 71-75 years	3	4	
Cataract (LOCS III)			0.261
♦ Grade II	54	48	
♦ Grade III	32	29	
♦ Grade IV	14	23	
No. Of Myopic Eyes (Up to -6.0D)	28	24	0.519
No. of hypermetropic Eyes (up to +5.0 D)	16	19	

Table-2: Per-operative complications.

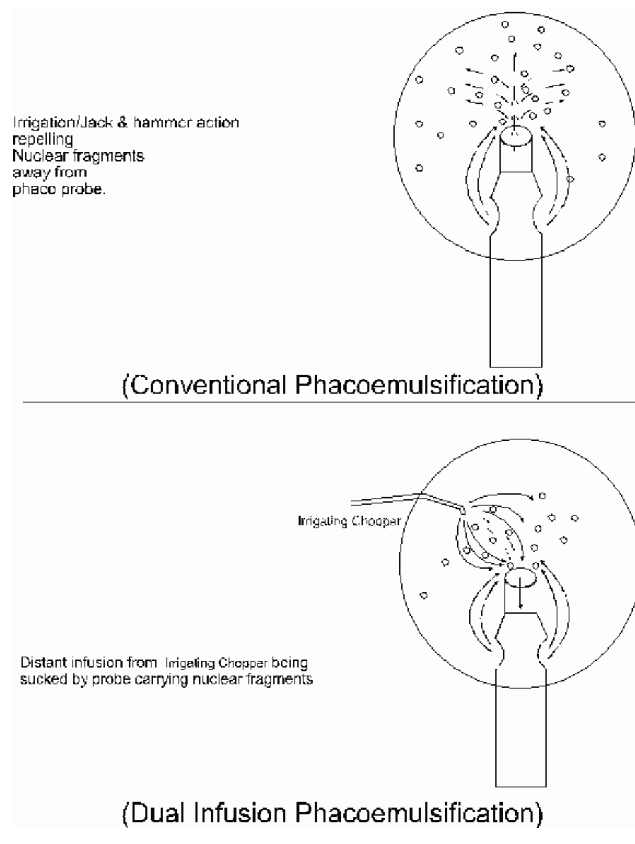
Complications	Group A (n=100)	Group B (n=100)	p-value
Extension of Capsulorrhexis	02	03	1.00
Anterior Chamber Collapse	Nil	09	0.003*
Phaco Tip Blocked / Choked	01	03	0.621
Wound Burn	Nil	04	0.121
Small pupil	03	04	1.00
Posterior Capsule Rent	02	02	1.00
Total No: of Complications	08	24	0.002*

* Significantly high number of anterior chamber collapse and total number of complications in group B (p=0.003 and p=0.002 respectively).

Table-3: Operative and post operative observations.

	Group A (n=100)	Group B (n=100)	p-value
Quantity of Ringer's Lactate used (ml)	180-330	130-260	
	260.2±55.07	195.8±35.0	<0.001*
Wound Gap	Nil	1	1
Striate Keratitis			
(Mild to moderate)	9	17	0.093
Cells / flare			
(More than 2+)	17	28	0.063

* Significantly high quantity of Ringer's Lactate used (p <0.001) in group A.

**Figure:**

chamber collapsed in 9 cases in group B but none experienced this in group A. Phaco tip was blocked /choked in 1 case in group A as opposed to 3 cases in group B. There was no wound burn in any case of group A while it was noted in 4 cases of group B. Pupil became small in 3 cases in group A as compared to 4 cases in group B. Posterior capsular rent occurred in 2 cases of both groups. So there were 8 complications in group A as compared to 24 complications in group B which was highly significant (p=0.002), (Table-2).

Post operatively in group A, there was no wound gap as opposed to one case in group B. There was greater incidence of striate keratitis and anterior chamber reaction in group B as opposed to group A. There was a statistically significant difference (p<0.001) of amount of Ringer's Lactate used during surgery with 180-330 ml (mean 260.2 ± 55.09) in group A as opposed to 130-260 ml (mean 195.8 ± 35.0) in group B (Table-3).

Discussion

Corneal endothelial damage during cataract surgery is a major concern for all Ophthalmologists. Older age, small pupil, high nucleus grade, large nucleus, type of intra-ocular lens, greater amount of total emitted ultrasound energy and longer duration of surgery are associated with endothelial cell loss.¹⁵⁻¹⁷ In our study, we controlled these factors by appropriate methodology to decrease the potential bias. The commonest age group in group A and B was between 51 to 60 years of age. However insignificant difference of age distribution was observed (p=0.893); therefore the influence of age was eliminated. The two groups had almost equal grades of cataract. There was also no significant difference in refractive errors of the two groups.

It has already been proved that the endothelial cell loss during phacoemulsification is inversely proportional to the depth of anterior chamber, and the anterior chamber maintainer (ACM) increases and maintains anterior chamber depth throughout phacoemulsification. The use of ACM controls and stabilizes intra-ocular pressure (IOP) at pre determined levels with minor fluctuations during phacoemulsification.^{18,19}

Chawla et al²⁰ noted in their series that the anterior chamber was well maintained in all patients throughout the surgery; posterior position of posterior capsule was maintained during irrigation/aspiration. Therefore, it should logically follow that the endothelial cell loss should be lesser with the use of ACM.

Milla et al²¹ compared the results of conventional phacoemulsification with and without anterior chamber infusion used during nuclear phacoemulsification. They used continuous anterior chamber infusion only during nuclear phacoemulsification through phaco probe. We used

irrigation chopper connected with extra infusion of Ringer's Lactate through side port and noted other advantages, which were also noted by Milla et al.²¹ Another study recently done by B K Nayak et al²² concluded that use of anterior chamber maintainer for continuous anterior chamber infusion and omission of ophthalmic viscosurgical device during phaco did not cause significant difference in corneal swelling or endothelial cell loss in the immediate postoperative period up to one month. In our study there were no significant corneal swelling ($p=0.093$) observed postoperatively.

Continuous anterior chamber infusion avoids intra-operative complications like anterior chamber collapse that can reduce the success of surgery. Continuous anterior chamber infusion compensates for fluid losses through corneal incision. There was significantly higher number of intra-operative complications in group B as compared to group A ($p=0.002$). There was no wound burn in group A while in group B 4 patients experienced it.

Additional infusion keeps anterior chamber deep and pushes the posterior capsule backwards. One can work on high vacuum comfortably. In irrigation and aspiration by conventional phaco handle, irrigation near the aspiration port pushes the nuclear fragments away from aspiration port while with dual infusion through separate distant infusion; fluid directs the nuclear fragments towards the aspiration port from distant periphery.

Due to unavailability of specular microscope, we could not assess the corneal endothelial cell count before and after dual infusion phacoemulsification through irrigating chopper. The safety and efficacy of this procedure can be better judged by count of endothelial cells lost by this extra infusion. More studies in this connection are required.

Conclusion

Anterior chamber maintainer has been tried before. They are useful but cumbersome. Dual infusion through irrigating chopper serves triple functions of irrigation, chopping and additional separate distant infusion. It improves anterior chamber stability and compensates surge and provides operative advantage to the surgeon.

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