



PHACOEMULSIFICATION; VISUAL ACUITY AND COMPLICATIONS OF PHACOEMULSIFICATION BY SENIOR SURGEON DURING LEARNING CURVE.

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ABSTRACT... Introduction: Any opacity in crystalline clear lens that may or may not impaired vision is called cataract. According to maturity of cataract it may be immature, mature or hypermature. When a patient develop cataract than there is no significant medical treatment for cataract. Surgery is the treatment of choice for cataract. Phacoemulsification (phaco), a modification of ECCE, has found worldwide popularity in last two decades. **Objectives:** To find out visual acuity and complications of phacoemulsification in patients operated by senior surgeon during learning curve.

Study Design: Descriptive case series. **Settings:** Department of Ophthalmology Independent University Hospital, Faisalabad. **Period:** One year from 01-04-2014 to 31-03-2015. **Data Collection Methods:** Patients coming through the OPD of the eye department who fulfilled the inclusion criteria were enrolled and informed consent was taken from all patients. **Results:** In this study 100 eyes had undergone Phacoemulsification with IOL under Local anesthesia during study period. The mean age of patients was 57.50 years (range 30-85 years). Regarding the visual acuity in operated eyes, 80 eyes (80 %) had a BCVA of 6/6-6/12, 12 eyes (12 %) had a BCVA of 6/18 to 6/36 and 6 eyes (6 %) had a BCVA of 6/60 to CF. While only 2 percent Patient had visual acuity less than Counting finger(CF). **Discussion:** During phaco training, the author was taught in stepwise about various stages of phaco and then author practice single part every stage of phaco multiple times to be master in every step of phaco under supervision of an experienced ophthalmologist. Due to learning of phaco step-by-step leads to good surgical outcomes and least complication rates. After learning the phaco basic training, the author started to perform phacoemulsification in Independent University Hospital Faisal Abad under the supervision of an experienced ophthalmologist followed by independently performing phacoemulsification. **Conclusion:** Surgeon experienced in ophthalmic surgery along with adequate phacoemulsification training leads to a good visual outcome with minimum per-operative and post-operative complications.

Key words: Phacoemulsification, cataract, learning curve

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INTRODUCTION

Any opacity in crystalline clear lens that may or may not impair vision is called cataract. According to maturity of cataract it may be immature, mature or hypermature. When a patient develops cataract than there is no significant medical treatment for cataract. Surgery is the treatment of choice for cataract. One method for cataract extraction is extracapsular cataract surgery (ECCE) with posterior chamber lens implantation. It is well

known reality that one of the most common intraocular surgery performed worldwide is Cataract surgery. Due to better visual outcome, extra-capsular cataract extraction (ECCE) has become a more commonly performed technique for cataract. While previous technique for cataract surgery that was intra-capsular cataract extraction (ICCE), which now is only performed in few selected cases like on subluxated lens either due to trauma or due some ocular disease

like Marfan, s syndrome.

Phacoemulsification (phaco), a modification of ECCE, has found worldwide popularity in last two decades. Regarding the history of phacoemulsification Charles Kelman was the first person who performed phacoemulsification in 1967.¹

Phacoemulsification can be carried on any type of cataract depending on experience of surgeon. After phacoemulsification intraocular lens (IOL) that may be rigid or foldable is implanted. Its advantage over ECCE is that relatively smaller incision is required which leads to lower post-operative astigmatism, less chances of infection and quicker rehabilitation time of the patient.² With advancement in phaco technology the outcome of cataract surgery have improved. That is why in developed countries like in Europe and USA phacoemulsification has become the preferred technique for cataract removal.³ American Society of Cataract and Refractive Surgeons (ASCRS) members conducted a survey regarding the practice styles for cataract removal than they concluded that only 3% ophthalmologists did not use the phacoemulsification.⁴ Similarly 93% of the members of Japanese Society of Cataract and Refractive Surgery preferred phacoemulsification as compared to conventional cataract surgery in Japan.⁵

However the scenario regarding the use of phacoemulsification in South Asian countries a decade before was opposite. For example India less than 5% of the eye surgeons performed phacoemulsification.⁶ In spite of fast development in phaco technology for cataract surgery in the industrialized world, it is still in developing phase in under-developed countries like in Pakistan. Most responsible factors include high cost phacoemulsification machine and difficult learning curve. Other major cause in developing countries, is development of manual suture less small incision cataract surgery (SICS) technique. The advantage of this technique is that it has been considered as a low cost surgery as it not required costly phaco machine as well as good option for treating large number of cataract in

developing countries.⁷

However In recent years, due to new technology in phacoemulsification machine the result of cataract surgery are very excellent that wise phacoemulsification is most demanding procedure by cataract patients as well as similarly patients' expectations about vision are also high. To stay in practice and fulfill the demands of patients, it is becoming compulsory to learn the technique of phacoemulsification.⁸

The author has good experience in ophthalmic surgery as well as after completing phaco training program, started performing phacoemulsification independently. Before to start Phaco independently author has studied basic literature on phacoemulsification, wet lab practice, learned different steps of phaco step-by-step especially CCC and watched multiple videos by various phaco surgeons than performed few cases of phacoemulsification under supervision.

The purpose of this study is to document and evaluate the outcome of phacoemulsification in the learning curve of an experienced extracapsular surgeon making a supervised transition from extracapsular cataract extraction (ECCE) to phacoemulsification.

OBJECTIVE

To find out improvement in visual acuity and complications of phacoemulsification in patients operated by senior surgeon during learning curve

MATERIAL AND METHODS

Study Design

- Descriptive case series.

Settings

- Department of Ophthalmology Independent University Hospital, Faisalabad.

Study Duration

The duration of study was one year from 01-04-2014 to 31-03-2015.

Sample Size

The total number of patients in this study was 100.

Sampling Technique

Non Probability, Consecutive sampling.

SAMPLE SELECTION

Inclusion Criteria

Patients having age range of 35-85 years of both gender and with grade one nuclear sclerosis to grade three nuclear sclerosis were included in this study. Some patients in study were presented with posterior sub capsular cataract without nuclear sclerosis.

Exclusion Criteria

Patients having history of antithrombotic drugs or aspirin, uncontrolled hypertension or diabetes mellitus as well as on examination having poorly dilated pupil, subluxated lens or having inadequate corneal transparency were not included in study.

Data Collection Methods

Patients coming through the OPD of the eye department who fulfilled the inclusion criteria were enrolled and informed consent was taken from all patients. In this study Preoperative visual acuity with snell chart, tonometry, slit lamp bio microscopy for anterior segment & posterior segment and IOL power calculations were recorded. Routine laboratory investigations were also advised. In all patients before surgery intra-venous cannula was passed as precautionary measure to encounter any emergency during surgery. After all aseptic precautions surgery was started. In all patients Peribulbar anesthesia along with Facial block was given. Silk 4/0 black for Superior rectus suture was used in few cases when required. Pupils were dilated with tropicamide 1%, phenylephrine 10% eye drops but in few diabetic cases for dilation even used atropine Sulphate.

Two side ports was made with 15 degree knife in which one side port for Capsulorhexis other was for chopper insertion during phaco. Three step tunnel incision was made at about 11 O' clock position with 3.2 mm phaco keratome. Capsular staining was done in all cases with methylene blue to enhance visibility of anterior capsule. Anterior chamber was filled with methylcellulose 2%. Capsulorhexis was done in all cases by bent

27G needle through side port. Capsulorhexis was not central and circular in few cases. In case of difficulty, capsulorhexis force were used for completion of the CCC. Conjunctiva Peritomy was done at main entry wound site with spring scissor. Before to start phaco, hydrodissection by hydrodissection cannula done in most of cases but in patients with mature or total white cataract only partial hydrodissection was done as well as in few cases especially with posterior polar cataract only hydrodelineation was done to avoid risk of capsular rent. Bimanual phacoemulsification technique was used in all cases.

The Oertli (catarhex easy) phaco machine was used. The stop and chop technique was used during phaco for nucleus break down. During surgery best attempt was made to perform entire emulsification and aspiration at the endocapsular level as much as possible but in few cases especially in soft cataract, supracapsular phaco was also performed to avoid posterior capsular rupture. After performing central sculpting of nucleus, the nucleus was broken into two parts followed chopping of all pieces. During central sculpting the parameters of phacoemulsification used were US energy of 30-60%; vacuum of 100-150 mmHg and aspiration flow rate (AFR) 20 cc/ min. After sculpting and nucleus division US energy was 30-50%, vacuum 200-280 mmHg and AFR 20 cc/min. The residual cortical matter was removed by Simco I/A cannula through side ports in cornea. The anterior chamber and bag were refilled with methylcellulose 2%. The incision was enlarged by 5.5 mm keratome or by No 11 knife. In about 85% cases phaco PMMA intraocular lens (IOL) were implanted with single 10/0 nylon suture at incision site.

In few patients Foldable IOL was used. Where there was large posterior capsular break, larger optic IOL was implanted in the sulcus. After completion of the surgery, all patients were injected with sub-conjunctival injection of gentamicin and dexamethasone. Antiseptic dressing was done in all patients and send back to home after two hours stay in hospital. Patients were followed in OPD on next day, after three days, after two weeks and then after one month.

Postoperative care consists of topical antibiotics (moxifloxacin) and steroids (prednisolone). In all patients on follow-up best corrected visual acuity, per-operative and postoperative complications were noted in all cases in Performa.

RESULTS

In this study 100 eyes had undergone Phacoemulsification with IOL under Local anesthesia during study period. The mean age of patients was 57.50 years (range 30-85 years). Fifty Two (52%) were male patients While female Patients in this study were 48 (48 %) (Figure-1). Sixty patients were found to have either diabetes mellitus or hypertension, or Suffering from both diseases but both diseases were controlled before surgery.

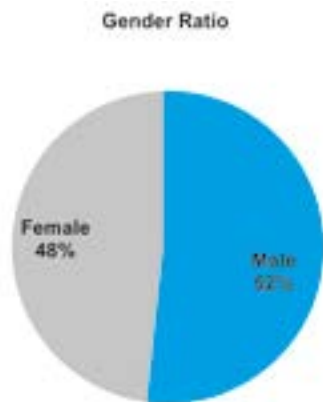


Figure-1. Showing Gender Ratio

Preoperative uncorrected visual acuity (UCVA) was 6/9—6/12 in 8 patients, 6/18—6/60 in 10 eyes, 6/60—CF was found in seventy percent patients while less than CF visual acuity recorded in only 12 patients. (Table-I)

Pre-operative UCVA	Number of Patients	Percentage
6/9—6/12	8	8%
6/18—6/36	10	10%
6/60—CF(Counting finger)	70	70%
Less than CF	12	12%
Total	100	100%

Table-I. Pre-operative Uncorrected Visual acuity of eyes that underwent phacoemulsification

Regarding the intra-operative complications,

three eyes (3 %) had posterior capsule rent (PCR), Nucleus Fragments dropped occurred in two cases(2%) while complete Nucleus dropped occurred in only one Patient. 1 eye (1%) had a Descemet’s membrane detachment; 5 eyes (5 %) had a CCC extension. In about Five patients phaco is converted in ECCE with IOL. Other complications that occurred in patients during intra-operative period were Sub-conjunctival hemorrhage in 15%, conjunctival chemosis in 10%, iris prolapse in 2% and Iris damage 2 %. (Table-II)

Intra-operative complications	Number of Patients	percentage
Nucleus fragments drop	2	2%
Nucleus drop	1	1%
Conversion to manual ECCE	5	5%
Posterior capsular rupture	3	3%
Iris prolapse	2	2%
Iris damage	2	2%
Subconjunctival hemorrhage	15	15%
Hyphaema	2	2%
Descemet’s membrane detachment	1	1%
Conjunctival chemosis	5	5%

Table-II. Intra-operative complications

Regarding the complications that noted in postoperative were striate Keratopathy in 15 %, bullous Keratopathy in two patients and Uveitis with grade 3 cells in 10(10%) eyes. Endophthalmitis occurred in only one patient. Residual Lens matter was present in three patient during post-operative period. (Table-III)

Post-operative complications	Number of Patients	Percentage
Striate Keratopathy	15	15%
Uveitis	15	15%
Endophthalmitis	1	1%
Decentration of IOL	1	1%
Residual Lens matter	3	3%
Bullous Keratopathy	2	2%
Iris atrophy	1	1%

Table-III. Post-operative complications

Regarding the visual acuity in operated eyes, 80 eyes (80 %) had a best corrected visual acuity of 6/6-6/12, 12 eyes (12 %) had a best corrected visual acuity of 6/18 to 6/36 and 6 eyes (6 %) had a best corrected visual acuity of 6/60 to CF. While only 2 percent Patient had visual acuity less than Counting finger (CF). (Table-IV)

Vision	Number of Patients	Percentage
6/6--6/12	80	80%
6/18—6/36	12	12%
6/60—CF	6	6%
Less than CF	2	2%
Total	100	100%

Table-IV. Post-operative best corrected visual acuity after six weeks

DISCUSSION

One of the basic human rights is right to see. Cataract is responsible for blindness in more people than any other single ocular disease if not treated in proper way and proper time. Cataract is not preventable but it is surgically curable. Quick rehabilitation and good visual acuity following cataract surgery is the aim of all ophthalmic surgeons. Due to small incision in phaco, it is now a widely practiced all around the world because due to faster rehabilitation of the patient's visual acuity. But one problem with new surgeons regarding phaco is that the phaco learning curve is sufficiently prolong and difficult. So it is important for ophthalmic surgeons learn the phaco in a safe manner. As Minimal intra-operative and postoperative complications are main concern every Surgeon. But the complications correlate themselves with the surgeon experience and technique. However improvement in post-operative visual acuity and reduction in per-operative and post-operative complications during phaco if Surgeon has good and adequate phaco training.

During phaco training, the author was taught in stepwise about various stages of phaco and then author practice single part every stage of phaco multiple times to be master in every step of phaco under supervision of an experienced

ophthalmologist. Due to learning of phaco step-by-step leads to good surgical outcomes and least complication rates. After learning the phaco basic training, the author started to perform phacoemulsification in Independent University Hospital Faisal Abad under the supervision of an experienced ophthalmologist followed by independently performing phacoemulsification.

One hundred eyes had undergone phacoemulsification over a one year study period. Few patients not completed follow up mostly likely cause may be long traveling distance. As in catchment area of this hospital patients belong to mostly rulars areas and second speculated because patients who get good vision in early post-operative period mostly not complete follow-up.

In this study, posterior capsule rupture (PCR) occurred in 3 eyes (3%). All such eyes had undergone a closed chamber anterior vitrectomy followed rigid posterior chamber IOL that was implanted in sulcus. Posterior capsule rupture occurred mainly during irrigation and aspiration stage when this step was done through main phaco entry wound. This complication not happened again when same step conducted through side ports. Our PCR is less as compared to other studies showing 10.0 -19.7% rate by learning surgeons.^{9,10}

In another study of 400 phacoemulsification operations capsular tear occurred in 6.3 %.¹¹ Posterior capsule rupture Rate was 9.9% in Cruz et al cases.¹²

In Juneijo study posterior capsule rupture rate was 4.5%.¹³ Nearly all phaco surgeons faced the problem of nucleus drop in their learning phase. Nucleus drop into vitreous ranged from 0.25% to 0.79% as described by national and international studies during phacoemulsification learning curve.^{14,15}

Nucleus drop was the problem, which developed in 1 % of our cases. This patient was referred to vitreoretinal surgeons for proper management. In one study analysis was done for visual acuity and

phaco induced complications in first 70 cases performed by two residents in learning curve. Both residents were experienced in standard manual ECCE. No nucleus was lost into the vitreous.¹⁶

In 3% of cases of posterior capsular rupture, author faced Nucleus fragments drop that was removed successfully and patients were managed conservatively.

Conversion to manual ECCE was done in 5 % cases .it was especially done in cases that had radial incision in rhexis so as to avoid major complication like nucleus drop author preferred to convert it into ECCE and nucleus was delivered followed by suturing of large incision.

In this study, other intra-operative complications that were found in 15 eyes (15 %) with Subconjunctival hemorrhage. In 2 % of cases there was damage to the iris either by phaco tip or by the chopper. This developed in those cases where pupil was not fully dilated and when there was iris prolapse (2%) through incision site. Popiela G et al reported iris damage in 4% of their cases during phaco.¹⁷

Regarding the postoperative corneal complications that was noted during study were striate Keratopathy that ranges from mild to moderate in intensity in 15 eyes (15%). While during phaco, 1 eye (1 %) developed Descemet's membrane detachment. Corneal complications were more common with increasing nuclear sclerosis due to increased use of phaco power during surgery. These results can be compared to study of 100 cases by a beginner phaco surgeon conducted by Ali et al in 2007, which reported operative corneal complications with corneal abrasion (40%), corneal hydration (3%) and Descemet's membrane detachment (3%).¹⁸

A study by Hennig et al (2004) showed that postoperative corneal complications causing reduced visual acuity were more common in patients operated by surgeons without formal phaco training (11/100 eyes). But surgeons with formal training in phaco taught by an experienced phaco-surgeon causes less corneal

complications (3/ 100 eyes).¹⁹

During study, one eyes was reported with vision threatening complication of Endophthalmitis. Endophthalmitis developed in 0.59% of cases in study of Gavris M et al.²⁰

Mild to moderate Uveitis occurred in 15 % of our cases. They were managed conservatively with topical steroids. IOL Decentration occurred in one eye.

In post-operative period, best corrected visual acuity (BCVA) between 6/6-6/12 in 80% cases. while In 12 (12 %) eyes best corrected visual acuity (BCVA) was in between 6/18-6/36. visual acuity between 6/60-CF and less than CF reported in only 6% and 2 % cases respectively.

During study, in patients who cannot achieve good visual acuity either had postoperative high astigmatism or due to pathology of funds like macular degeneration due to aging. Other possible cause especially in diabetic patients were diabetic retinopathy with maculopathy.

Dholakia SA et al conducted prospective study of 173 patients in 2004. They follow their patients for a period of three year. On the last follow-up, Dholakia SA et al showed that 146 eyes (88.89%) had a BCVA of better than 6/18.²¹ A study conducted by Ruit et al in 2007 on phacoemulsification by trained ophthalmologists for time period of six months has reported BCVA equal to or better than 6/18 in 98% of patients.²² 98.5% of eyes had BCVA of better than 6/18 in study of Gogate et al in patients that had undergone phacoemulsification.²³

CONCLUSION

Surgeon experienced in ophthalmic surgery along with adequate phacoemulsification training leads to a good visual outcome with minimum per-operative and post-operative complications.


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REFERENCES

1. Kelman et al (1967). Kelman CD (1967). **Phacoemulsification and aspiration. A new technique of cataract removal.** A preliminary report. Am J

- Ophthalmol. 1967. 64(1):23-35.
2. Kanski JJ. **Clinical ophthalmology**. 5th Ed. London: Butterworth & Heinmann 2003; 165-73.
 3. Lundstrom M, Stenevi U, Thorburn W (2002). **The Swedish National Cataract Register: A 9-year review**. ActaOphthalmolScand;2002 (3):248-57.
 4. Leaming DV (2002). **Practice styles and preferences of ASCRS member's 2001 survey**. J Cataract Refract Surg; 2001 .28:1681-1688.
 5. Oshika T, Amano S, Araie M, Majima Y and Leaming DV (2000). **Current trends in cataract and refractive surgery in Japan: survey**. Jpn J Ophthalmol; 2000. 44:268-276.
 6. Basti S (1999). **Cataract surgery in emerging nations: role of phacoemulsification**. In Masket S, Crandall AS, editors. Atlas of Cataract Surgery. London: MartinDunitz Ltd: 105-110.
 7. Ruit S, Tabin G, Chang D, et al (2007). **A prospective randomized clinical trial of phacoemulsification vs manual suture less small incision extra capsular cataract surgery in Nepal**. Am J Ophthalmol; 2007. 143:32-38.
 8. Durrani J. **Phacoemulsification: to convert or not to convert?** Pak J Ophthalmol. 1995; 11: 47-8.
 9. Cotlier E, Rose M (1976). **Cataract extraction by the intracapsular method and by phacoemulsification: The results of surgeons entraining**. Trans Am Acad Ophthalmol Otolaryngol; 1982. 81:163-182.
 10. Hennig A, Schroeder B, Kumar J (2004). **Learning phacoemulsification. Results of different teaching methods**. Indian J Ophthalmol; 2009.52:233- 234.
 11. Seward HC, Dalton R, Davis A. Phacoemulsification during the learning curve: risk/benefit analysis. Eye. 1993; 7: 164-8.
 12. Curz OA, Wallace GW, Gay CA, et al. **Visual results and complications of phacoemulsification with intraocular lens implantation performed by ophthalmology residents**. Ophthalmology. 1992; 99: 448-52.
 13. Junejo SA, Khan SA. **Phacoemulsification by stops and chop technique: Review of 200 cases**. Pak J Ophthalmol. 1999; 15: 138-41.
 14. Gavris M, Caciula D, Popa D, et al: **Phacoemulsification personal experience on my first 507 cases**. Oftalmologia. 2004; 48: 48-52.
 15. Hashmani S, Haider I, Khan MA. **Phacoemulsification results and complications during the learning curve**. Pak J Ophthalmol. 1997; 13: 32-6.7,10.
 16. Thomas R, Naveen S, Jacob A, et al. **A Visual outcome and complications of residents learning phacoemulsification**. Indian J Ophthalmol. 1997; 45: 215-.
 17. Popiela G, Markuszewska J, Chelstowska J, et al. **Analysis of phacoemulsification complications during mastering of the method**. Klin Oczna. 2004; 106: 23-7.
 18. Ali A, Ahmed T, et al. (2007). **Corneal problems during and after phacoemulsification by beginner phacoemulsification surgeon**. Pak J Med Sci; 2007.23(3):401-404.
 19. Hennig A, Schroeder B, Kumar J (2004). **Learning phacoemulsification. Results of different teaching methods**. Indian J Ophthalmol; 2011.52:233- 234.
 20. Gavris M, Caciula D, Popa D, et al: **Phacoemulsification personal experience on my first 507 cases**. Oftalmologia. 2004; 48: 48-52.
 21. Dholakia SA, Vasavada AR (2004). **Intraoperative performance and long-term outcome of phacoemulsification in age-related cataract**. Indian J Ophthalmol. 2004. 52:311-317.
 22. Ruit S, Tabin G, Chang D, et al (2007). **A prospective randomized clinical trial of phacoemulsification vs manual suture less small incision extra capsular cataract surgery in Nepal**. Am J Ophthalmol; 2007. 143:32-38.
 23. Gogate P, Ambardekar P, Kulkarni S, et al. (2010). **Comparison of endothelial cell loss after cataract surgery: Phacoemulsification versus manual small-incision cataract surgery**. J Cataract Refract Surg; 2010. 36:247-253.

AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Dr. Faheem Ahmad	Concept & design, data collection, critical expertise & writing & final approval	
2	Syeda Iqra Iqbal	Help in Data collection	