

Original Research Article

Statistical evaluation of intraoperative and postoperative complications occurring during learning curve of various techniques of cataract surgery at a teaching hospital in north Karnataka

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ABSTRACT

Background: Aim of cataract surgery is, no longer restricted just to visual restoration, but is now considered to be a Refractive surgery i.e. to achieve state of emmetropia. The surgical technique has revolutionized rapidly from Intracapsular cataract extraction to Extra-capsular cataract extraction, from sutured surgery to sutureless cataract extraction to most advanced technique of Phacoemulsification. Adopting a new technique requires development of skill that differ from previous experience.

Methods: This was a prospective study carried out at MR Medical College, Gulbarga from November 2012 to August 2014. The surgeons were categorized in three groups. The patients included in the study were equally distributed amongst the surgeons by purposive random sampling technique. All the surgeries were performed under microscope with the use of viscoelastics manufactured by same company. The surgeries were performed under the supervision of trainer, who guided or took over the case, whenever it was required. The intra-operative and post-operative findings were noted and they were statistically analysed by using various statistical tests.

Results: A total of 270 patients out of which 123 (45.55%) were males and 147 (54.44%) females Overall intraocular complication in the study was seen in 33 eyes, maximum was posterior capsular rent seen in 19 cases. Among post-operative findings corneal edema was in 133 cases. Statistical analysis of the study showed that there is significant difference regarding post-operative complications.

Conclusions: Rate of complications was seen higher with learning of non-phaco SICS. If a surgeon is well versed with tunnel making and CCC the learning curve for phacoemulsification can be reduced. Immediate visual restoration was better in eyes that underwent phacoemulsification, though they were operated by training surgeons.

Keywords: Evaluation, Complications, Cataract, Surgeons

INTRODUCTION

Aim of cataract surgery is, no longer restricted just to visual restoration, but is now considered to be a Refractive surgery i.e. to achieve state of emmetropia. Because of these changing trends regarding results of cataract surgery, the surgical technique has revolutionized rapidly from Intracapsular cataract extraction to extra-capsular cataract extraction, from

sutured surgery to sutureless cataract extraction to most advanced technique of phacoemulsification.¹ Changes in the technique have been benefited by advances made in calculation of accurate power of intra-ocular lenses by keratometry and A-scan biometry. To reduce post-operative astigmatism lots of work has been done. Depending on its results site and size of incision is now altered.

Also, the early demand for visual rehabilitation, is forcing the Ophthalmologists to adopt new technology. This is creating dilemma for established and younger Ophthalmologist to switch over newer techniques. Adopting a new technique requires development of skill that differs from previous experience.

Before the surgeon acquires skill over new technique, he has to go through the phase of the learning, where he faces problems while operating. Study of these cases can help surgeon himself and the trainer to find out the simple ways to reduce the duration of learning curve. To find out the rate of various complications encountered while adopting newer technique.

This study was undertaken to find out the rate of various complications encountered while adopting newer technique. The objective was to compare the rate of complications at various stages of learning and to compare the rate of complications amongst each technique during learning phase.

METHODS

This was a prospective study carried out at MR Medical College, Gulbarga from November, 2012 to August, 2014. Institution ethics committee approval was taken.

In this study 270 patients, 123 males and 147 females and nine Ophthalmic surgeons were included after obtaining consent from them. The surgeons were categorized in three groups, with three surgeons in each.

- Group A: Surgeons learning conventional extra capsular cataract extraction (ECCE).
- Group B: Surgeons learning Small Incision non phaco cataract surgery (SICS).
- Group C: Surgeons learning phacoemulsification.

The patients included in the study were equally distributed amongst the surgeons by purposive random sampling technique. All patients had senile cataract without obvious ocular co-morbidity like corneal opacity, glaucoma, previous uveitis, pseudoexfoliation or obvious retinal pathology. Diabetic and hypertensive patients were excluded from study. Each case was examined with detailed history regarding their complaints, the onset and duration of complaints. Preliminary examination with torch and loupe was done. Pre-operative visual acuity was determined. Detailed slit lamp examination and fundus examination was done. IOP measurement using Schiottz tonometer and syringing to test potency of lacrimal passages was done in all cases IOL power was calculated by keratometer and a scan. Suture material used was 10.0 nylon.

All the surgeries were performed under microscope with the use of viscoelastics manufactured by same company. All the surgeries were performed under peribulbar anesthesia. All patients received tab. Ciprofloxacin +

tinidazole combination prior to surgery. The pupil was dilated with tropicamide (0.8%) + phenylephrine (5%). Tropical antibiotic (ciprofloxacin eye drop 0.3%) was instilled every ½ hours for 6 times prior to surgery. Eyelashes were cut a day before surgery.

Criteria for selection of surgeon from training programme:

- For ECCE: Those who have performed less than 10 surgeries. Those who are not in touch with surgery for at least 1 year
- For SICS: Those who have performed minimum 100 cases of ECCE
- For Phaco: Surgeons who have performed minimum 100 cases of SICS.

Surgical technique

In ECCE, sclero-corneal section was made from 2 0 clock to 10 0 clock (12-14 mm) after raising conjunctival flap. The lens capsule opened, either by envelope or can-opener technique. Nucleus expressed by vectis and Arruga's forceps. Cortex was aspirated by Simcoe cannula. PCIOL placed. Section sutured with 5 interrupted sutures with 10-0 nylon.

In non phaco SICS, 6.5 to 7.0 mm scleral tunnel was created with frown incision. A side port was created to facilitate intraocular manipulations. Capsule was opened by can-opener or continuous curvilinear capsulorrhexis (CCC) through sideport. Nucleus was dislocated into anterior chamber after hydroprocedures. The nucleus was expressed out as a whole by visco expression. Remaining cortex was aspirated by Simcoe cannula and PMMA PCIOL was placed. The irrigating fluid was inserted through sideport to test the integrity of tunnel.

In phacoemulsification, 5.0 mm scleral tunnel made. The capsule was opened with CCC. Hydrodissection and hydrodelineation done. Nucleus was emulsified after trenching and cracking it into four quadrants, with peristaltic pump. Cortex was aspirated by Bimanual Irrigation - Aspiration system. PCIOL placed in the bag. Side ports were hydrated. The surgeries were performed under the supervision of trainer, who guided or took over the case, whenever it was required. The intra-operative and post-operative findings were noted and they were statistically analysed by using various statistical tests.

Chi square test of goodness of fit was used to compare results of surgeons own consecutive 10 cases. Z-test was used to compare various complications that occurred in three groups.

RESULTS

A total of 270 patients out of which 123 (45.55%) were males and 147 (54.44%) females. Maximum number of

cases belonged to age group 61-65, (70, 25.9%) followed by 56-60 age group 25.55% (Table 1).

Table 1: Age and sex wise distribution of cases.

Age group	No. of male	No. of females	Total
41-45	2	5	7
46-50	7	10	17
51-55	7	8	15
56-60	23	46	69
61-65	36	34	70
66-70	35	31	36
71-75	8	5	13
76-80	5	3	8
81-85	-	3	3
86-90	-	1	1
95-100	-	1	1
Total	123	147	270

Overall intraocular complication in the study was seen in 33 eyes, maximum was posterior capsular rent seen in 19 cases; wound related complications in 5 cases, Zonular Dialysis in 5 cases Iridodialysis in 2 cases and decentration of IOL in 2 cases. Intraoperative complications among groups a, b, c are shown in Figure 1.

- A- ECCE
- B- Non phaco SICS
- C- Phacoemulsification

Among post operative findings corneal edema was in 133 cases followed by striate keratopathy. Comparison of post-operative findings among 3 groups is shown in Table 2. Over all Complications were more among group b - 152 followed by group c and group a. comparison of complications is shown in Table 4.

Statistical analysis of the study showed that there is significant difference regarding post-operative complications, namely corneal oedema, striate keratopathy and anterior chamber reaction (P<0.05, Z test

was applied), while there was no significant difference related to various intraoperative complications (P>0.05, Z test was applied).

There is no significant difference seen during various stages of learning i.e. when each 10 cases were compared with next 10 cases, and again with last 10 cases (P<0.05, chi square test of goodness of fit was applied). It is difficult to comment that minimum how many cases a surgeon requires to be well versed with the technique, as mastering a technique depends on self-skill. Comparing overall intraoperative and postoperative findings amongst three groups showed significant difference amongst them (P<0.01, Z test was applied).

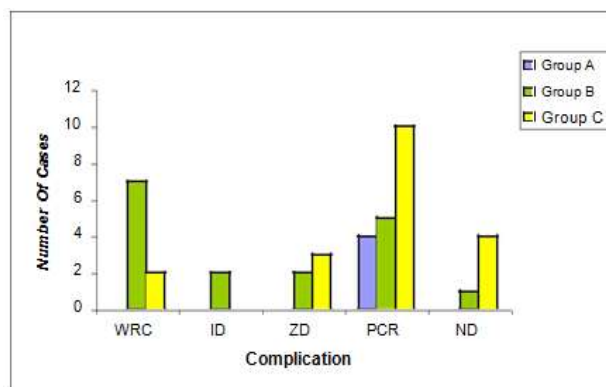


Figure 1: Comparison of intraoperative complications.

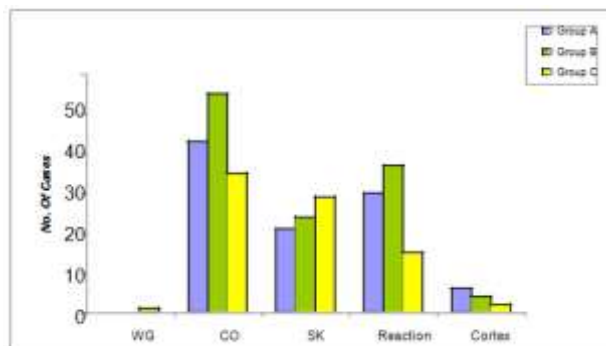


Figure 2: Comparison of post-operative findings.

Table 2: Comparison of complication.

Complications	Group A	Group B	Group C
Wound related complications	-	7 (7.7 %)	2 (2.2 %)
Corneal oedema	43 (47.7 %)	56 (62.22 %)	30 (33.33 %)
Striate keratopathy	22 (24.44 %)	34 (37.7 %)	29 (32.2 %)
Corneal burn	-	-	1 (1.1 %)
Reaction	28 (31.11 %)	34 (37.78 %)	17 (18.89 %)
Iridodialysis	-	2 (2.2 %)	-
Zonular dialysis	-	3 (3.3 %)	2 (2.2 %)
Posterior capsular rent	4 (4.4 %)	5 (5.5 %)	10 (11.1 %)
Nucleus drop	-	1 (1.1 %)	4 (4.4 %)

Table 3: Comparison of visual acuity.

Group	1 st Post-operative day (UA)			8 th Post-operative day (UA)			6 weeks follow up (BCVA)			Pt. not for 6 weeks f/u
	<6/60	6/60-6/18	6/12-6/6	<6/60	6/60-6/18	6/12-6/6	<6/60	6/60-6/18	6/12-6/6	
A	18 (20%)	70 (77.78%)	2 (2.2%)	13 (14.44%)	68 (75.76%)	9 (10%)	3 (3.61%)	33 (39.75%)	47 (56.63%)	7 (7.7%)
B	16 (17.78%)	73 (81.11%)	1 (1.11%)	10 (11.11%)	71 (78.89%)	9 (10%)	3 (3.7%)	7 (8.64%)	71 (87.65%)	9 (9.9%)
C	7 (7.78)	65 (72.2%)	18 (20%)	5 (5.56%)	56 (62.22%)	29 (32.22%)	3 (3.75%)	5 (6.25%)	72 (90%)	10 (11.1%)

UA-unaided visual acuity; BCVA-best corrected visual acuity;

DISCUSSION

Overall intraocular complication in the study was seen in 33 eyes, maximum was posterior capsular rent seen in 19 cases; wound related complications in 5 cases, Zonular Dialysis in 5 cases Iridodialysis in 2 cases and decentration of IOL in 2 cases.

Posterior capsular rent (PCR) was seen in 10 case of phacoemulsification, 5 cases of manual SICS and 4 cases of ECCE. Out of 10 cases of phacoemulsification, the incidence of PCR was seen maximum i.e. in 7 cases while emulsifying last piece. So last piece if emulsified carefully after filling the chamber with viscoelastics and lowering the parameters, the rate of PCR can be reduced. In the study conducted by R. Thomas et al also indicates higher rate of PCR in phacoemulsification before cortical aspiration (phacoemulsification-a surgeon’s learning curve).²

In ECCE and SICS there no such prediction for one particular step. It occurred during aspiration of cortex, after nucleus delivery and while dialing the IOL.

In case of SICS, dislocating nucleus through small CCC resulted with PCR. Hence, size of CCC should be slightly larger. Also the rate of PCR was found maximum, as surgeon is always in fear of corneal damage; hence surgeon prefers to go slightly away from the cornea and towards posterior capsule.

Blomquist PH, Rugwani PM also reported higher incidence of PCR in phacoemulsification in compare with ECCE.³ In the study of Mihir M et al, vitreous loss seen with Blumenthal’s technique was 8.1% and with ECCE it was 8.3%.⁴ S. Tony Fernandez et. al reported 11.6% PCR in his study of early 500 cases of PCIOL.⁵

Table 4: Comparison of posterior capsular rent complication among various studies.

Complication	National survey Study ⁶	Mehmuod alhasan study ⁷	Galmi study ⁸	Browning DJ ⁹	Present study
Posterior capsular rent	4.4 %	5.6 %	10 %	17 %	7.04 %

There is no consistency regarding occurrence of PCR in various studies. Browning DJ. Reported vitreous loss in 9% cases, 17% cases with PCR in first 25 cases of ECCE done by residents.⁹

Wound related complications were more with surgeons learning, manual SICS (7.7%) compared to those learning phacoemulsification (2.2%) because tunnel making is a new step, which needed more skill and judgment and compared with phacoemulsification tunnel size is larger. While it was 8.4% in Seema Bhel et al study.¹⁰ The above difference is due to involvement of more surgeons in Dr.Seema Bhel’s study whereas in present study only 6 surgeons were involved.

Wound leak was seen in only one case of phacoemulsification, having tunnel burn. None of the cases with conventional ECCE had wound related complications.

The incidence of corneal oedema and striate keratopathy was seen maximum with manual SICS (37.7%) compared to conventional ECCE (25.5%) and phacoemulsification (32.2%). Reason here being;

- Retained viscoelastic in AC in many cases.
- Increased maneuvering in AC in expressing Nucleus after bringing it into AC.

In case of ECCE (conventional), the cause of corneal oedema and striate keratopathy was due to less experience of the surgeons.

Corneal oedema and striate keratitis resolved within 8 days except in 3 cases. These were compared with study conducted by Sudhakar J et al.¹¹ They found mild transient striate keratitis in nearly all cases that cleared up within 3 days.

This study results are comparable with Mahamuod Alhassan et al study 7; as in both studies the surgeon operating was a trainee, while the incidence is quite high as compared to national survey study and Sudhakar J et al study were the cases operated by an experienced surgeon.^{6,11} Incidence of anterior chamber reaction was found more with manual SICS (37.78%) followed by conventional ECCE (31.11%) and phacoemulsification (18.89%) respectively.

Table 5: Corneal edema complication in various studies.

Complication	National survey study ⁶	Mahamuod Alhassan et al ⁷	Sudhakar J et al ¹¹	Present study
Corneal Oedema	9.5 %	44.6 %	1.7 %	47.78 %

Reason

- Iris handling was more; while bringing nucleus into AC
- Iris touch by canula during hydroprocedures and during aspiration of subincisional cortex. It was least with phacoemulsification as maximum or near total procedure being done is in the bag (endocapsular).

Zonular Dialysis was seen in 3 cases (1.85%) manual SICS where CCC was done and in phacoemulsification, mainly during aspiration of cortex. If surgeon focuses the capsular rim and then aspirates the cortex, this complication is unlikely to occur. Dr. Seema Bhel reported Zonular dialysis in 3.68% of phacoemulsification.¹⁰

In manual SICS, it can occur while dialing the nucleus through slightly smaller CCC. Thus adequate CCC has two benefits in manual SICS it reduces changes of posterior capsular rent and zonular dialysis.

Iridodialysis occurred superiorly only in two cases of manual SICS. This occurred during viscoexpression of nucleus through inadequate internal tunnel, where initially iris prolapsed due to excessive viscoelastic in anterior chamber, making iris flabby. Now, if still more viscoelastic is injected, superior pole of nucleus goes behind the iris and then leaves eye after tearing iris from its root. Thus adequate incision and early prediction can prevent this complication. In this study none of the patient had Descemet’s detachment or iris prolapse. Cystoid macular oedema was seen in 2 eyes, 1 with SICS and other with phacoemulsification.

Out of 270 eyes, 3 eyes were left Aphakic, in 2 eyes ACIOL was implanted while all other eyes had PCIOL implant. The axis of post-operative astigmatism was not consistent with ECCE group at the stage of experience. While in phaco and SICS group it was against the rule

astigmatism ranging from (- 0.5 to -1.5 x 90 0) and (-1.0 to 2.75 x 90 0) respectively. Final V/A was better with manual SICS and phacoemulsification almost near to 88% and 91% respectively. This is comparable with the studies of Tabandeh H et al and Thomas et al.^{2,12}

Though all the techniques carry some complication in ECCE it needs extra skill to learn proper suture technique.

In SICS, surgeons need to learn tunnel making, CCC; bringing nucleus in AC and then expressing it out. In Phaco, one has to adopt himself using both hands and coordinate with foot switch.

Though the rate of complications noted were slightly higher in SICS compared with other groups, this study have tried to find out the cause. If taken care of, the learning curve may still be reduced and will keep surgeons confidence up.

CONCLUSION

Rate of complications was seen higher with learning of non-phaco SICS.

Wound related complications was seen more with non-phaco SICS compared to phaco as making scleral tunnel is an additional step in SICS. Also, the size of tunnel is larger with SICS. PCR was maximum while emulsifying last piece of nucleus, so additional precaution taken at this stage can reduce high incidence of PCR with nucleus drop.

Corneal oedema though transient was seen more with SICS, due to retained viscoelastics. Reaction was also seen more with SICS, as iris is handled more while bringing nucleus into AC and then delivering it. Residual cortex was seen more in SICS those underwent

conventional ECCE, as the surgeon has less surgical experience and more fear of damaging posterior capsule.

Zonular dialysis was seen in cases of SICS and phacoemulsification with CCC. Thus, in this study it was noticed to be related with CCC. In our study, Iridodialysis occurred when attempt was made to express nucleus through smaller tunnel in SICS.

If a surgeon is well versed with tunnel making and CCC the learning curve for phacoemulsification can be reduced. Immediate visual restoration was better in eyes that underwent phacoemulsification, though they were operated by training surgeons, but there was no much difference in BCVA at one and half months post-operative in the eyes those undergoing SICS and phacoemulsification.

Suturing requires more skill in order to control the astigmatism. Hence, facility of wet lab may help surgeon to grasp technique more efficiently and reduce his learning curve while operating on patient.

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