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Clinical assessment of corneal complications of manual small incision cataract surgery at tertiary care centre

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ABSTRACT

Aim: To assess corneal complications and visual outcome of manual small incision cataract surgery.
Materials and Methods: This study comprises of 227 patients in a tertiary care centre in Kolar district, who underwent MSICS were examined for corneal complications and visual outcome postoperatively on Day 1, 1 week, and at the end of 6^{th} week also visual acuity (VA) assessment, anterior segment evaluation with slit lamp biomicroscopy, posterior segment evaluation using indirect ophthalmoscopy, and keratometry was done.
Results: 227 participants were included in the study, of whom 138 (61%) were female and 89 (39%) were male. The maximum number of patients being in the age group of 61-70 (42.7%). OCTET grading was done for corneal edema patients and on post op Day 1, total 62 patients who had corneal edema in the study were graded according to OCTET classification, and 6 patients (9.6%) had grade 1, 17 patients (27.4%) had grade 2 and 39 patients (63%) had grade 3. At the end of 6^{th} week postoperatively, 45 patients had clear cornea, and 5 patients (8%) had grade 1, 6 patients (9.5%) had grade 2, and 7 patients (11.1%) had grade 3, and 82.3% of patients had VA of 6/6 to 6/9 followed by 11% had 6/12 to 6/18 and 6.6% had 6/24 to 6/36.
Conclusion: Small incision cataract surgery is most cost-effective surgery if corneal endothelium is protected during surgery and will have early visual rehabilitation.

1. Introduction

There are 12.5 million blind people in India, and it is thought that cataracts are the primary cause of 50% to 80% of those blindness.[1] A cataract is the impairment of lens transparency brought on by the lens opacification.[2] In 2020, cataract was the main cause of blindness in people over 50 years of age.[3]

The most popular and effective eye surgery is cataract extraction with intraocular lens implantation. The goal of surgery is not only to restore vision; rather, it was increasingly viewed as a refractive procedure to achieve emmetropia.

Manual small-incision cataract surgery (MSICS) is economical, secure, and has favourable optical outcome.[4] One of the major determinant of refractive status of the eye is cornea.[5] However, new developments in surgery has also led to a variety of new corneal complications, such as endothelial damage, epithelial toxicity, DM detachment, sterile corneal ulcer, etc. According to the Collaborative Eye Disease Prevalence Study, the number of people who have had cataract surgery will double over the next 20 years, from 6.70 million in 2000 to 10.0 million in year 2020.[6] Most of these patients are socioeconomically underprivileged and unable to pay for treatments like phacoemulsification.

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Recent studies show that Extracapsular cataract extraction with Posterior chamber intra ocular lens (ECCE-PCIOL) and MSICS are both safe and effective ways to treat cataract, however MSICS results in better uncorrected vision. The surgical procedures for cataract extraction have evolved significantly, from intracapsular extraction to phacoemulsification. Following cataract surgery, phacoemulsification provides good anatomical and functional results and has become the gold standard technique in industrialised countries.[7,8] Even though MSICS can be a relatively inexpensive operation, more research on its results is necessary. This study presents the findings of an observational prospective study conducted to evaluate the safety and effectiveness of MSICS.

2. Materials and Methods

It was a prospective cohort study that included 227 subjects with clinically significant cataract who had fulfilled inclusion and exclusion criteria, were admitted for cataract surgery in ophthalmology department in Kolar district, and had post-operative follow up as outpatient at the same hospital.

All consecutive cases were collected using piloted proforma meeting the objectives of study. Patients were examined by taking complete history with comorbidities if present. Patients were examined for VA, slit lamp evaluation pupil reaction, cataract grading and fundus examination with IDO or with 90 D lens. Intraocular pressure was done using a Goldmann applanation tonometer. B-Scan was done for mature cataracts due to the invisibility of fundus. Preoperative keratometry values were taken with Bausch and Lomb Keratometer and intra ocular lens power calculation by Sanders-Retzlaff-Kraff 2 (SRK 2 Method). Informed consent from all the patients were taken prior to surgery and advised to instill prophylactic antibiotic drops, with test dose of xylocaine on previous day of surgery. And all surgeries of the patients included in study were done by a single surgeon. Post operatively corneal complications and visual acuity were assessed on Day 1, 1^{st} week, and at the end of 6^{th} week using OCTET classification.

2.1. Inclusion criteria

1. All patients with clinically significant senile cataract (immature/mature) above 50 years and less than 80 years undergoing MSICS with PCIOL implantation.
2. Patients with pharmacologically dilated pupil with >6mm.

2.2. Exclusion criteria

Patients with 1) traumatic or congenital cataract, pseudo exfoliation syndrome, glaucoma or corneal opacity. 2) history of uveitis. 3) Previous intraocular surgery. 4) diabetic retinopathy and hypertensive retinopathy. 5) corneal dystrophy/ degeneration

2.3. Surgical technique

2.3.1. Preoperative

Preoperatively pupil was dilated by instilling tropicamide 0.8% with phenylephrine 5%.

2.3.2. Intra Operative

Conjunctival peritomy of 7 to 8 millimetres made. Cautery was used to achieve haemostasis. 5 – 6 millimetre incision in sclera is made with 15 blade number of about $1/3^{rd}$ of thickness of sclera. Corneo scleral tunnel was made using crescent knife. Side port was made at nine O'clock position in clear cornea with 15° side port entry blade about 1 mm from the limbus.

Air had been injected into AC through side port. Trypan blue (0.06%) is used to stain anterior capsule after diluting in to AC. 2% Hydroxy propyl methyl cellulose (HPMC) was injected to AC. With 26 guage bent needle like cystitome, 6mm capsulorrhexis is done. Hydrodissection is done by injecting saline between capsule and nucleus. Using Sinskey hook, one pole of nucleus is lifted and prolapsed in to AC. Then nucleus is delivered by sandwich method. Cortical wash was done using Simcoe's cannula and 2% HPMC is injected in AC. Finally, single piece Polymethyl methacrylate Intra ocular lens of 6mm optic size was implanted in posterior chamber. AC was formed with BSS and injection of gentamycin 40mg 0.4ml and dexamethasone 4mg 0.4ml given sub conjunctivally and eye patching is done with sterile gauze pad.

2.3.3. Postoperative

VA and Slit lamp evaluation were done on first postop day in all patients and corneal complication as epithelial bullae, striate keratopathy, Descemet's detachment and anterior chamber reaction if present were documented. Topical medications (Ciplox 0.3% Dexamethasone 0.1%) were given postoperatively to all patients which are used hourly for 1 week then over 3 weeks tapering was done. All patients were followed up on post op day 7, and at end of 6^{th} week. Both UCVA, BCVA were documented at each follow up. During each visit UCVA & BCVA were recorded. Corneal edema is further graded according to OCTET classification i.e., Oxford cataract Treatment and Evaluation Team Classfication.[9]

Transient corneal edema – 1+

Transient corneal edema with less than 10 DM folds- 2+

Transient corneal edema with more than 10 DM folds – 3+

And epithelial bullae, infectious keratitis, striate keratopathy (SK), Descemet's detachment, Epithelial downgrowth, and Fibrous ingrowth. Intraocular lens position and posterior segment was also examined.

2.4. Statistical methods

All the data has been entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test or Fischer's exact test (for 2x2 tables only) was used as test of significance for qualitative data.

Continuous data was represented as mean and standard deviation. Independent t test was used as test of significance to identify the mean difference between two quantitative variables.

2.5. Graphical representation of data

Microsoft Excel and Microsoft word was used to obtain various types of graphs.

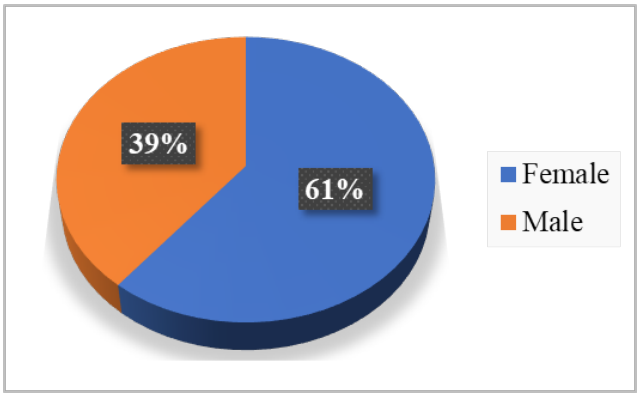
P value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

2.6. Statistical software

Microsoft Excel**,** Statistical package for the social sciences 22(SPSS version 22) (IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

3. Results

227 participants were included in the study, in which 138(61%) were females and 89 (39%) were males. Majority of the patients were in age group of 61-70 (42.7%).

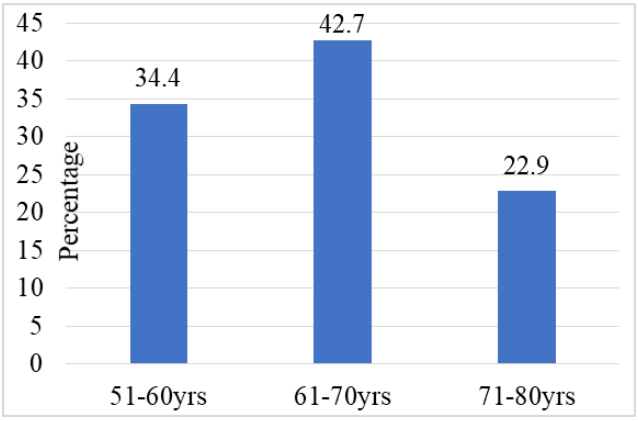


Graph 1: Graph showing distribution of subjects according to sex

All the risk factors assessed were statistically significant (p value <0.001).

4. Discussion

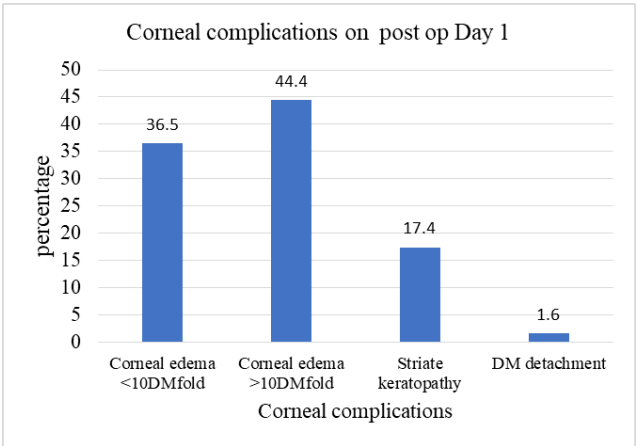
In emerging nations like India, a significant amount of cataract surgeries is performed on patients with senile cataracts. Phacoemulsification procedures continue to be an



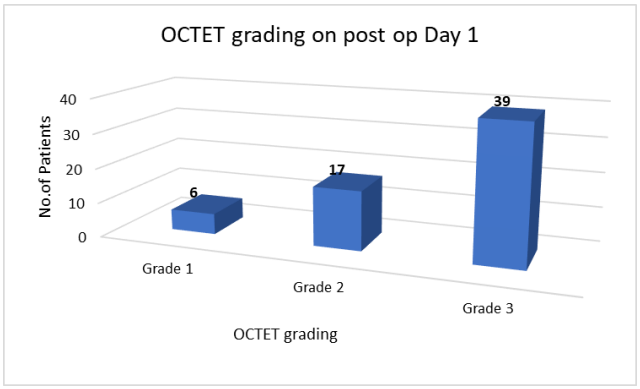
Graph 2: Graph showing distribution of subjects according to Age

Table 1: Distribution of subjects according to type of cataract

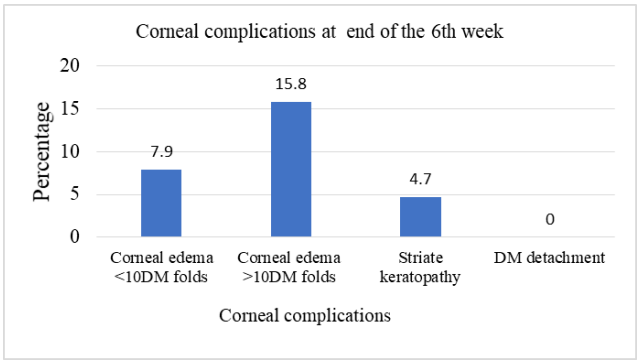
Nuclear grading	**Frequency**	**Percentage (%)**
NS 1	23	10
NS 2	56	25
NS3	39	17
NS4	9	4
Total	**127**	**56%**
Type of Cataract	**Frequency**	**Percentage (%)**
SMC	62	27%
SHMC	38	17%
Total	**100**	**44%**



Graph 3: Frequency distribution of various corneal complications at Postop Day 1



Graph 4: Bar diagram showing OCTET grading on postop Day 1



Graph 5: Bar diagram showing frequency distribution of various corneal complications at end of the 6^{th} week

Table 2: Frequency distribution of Risk factors for complications

Risk factors	Frequency	Percentage (%)	P value
Prolonged surgery	9	4.0	<0.001
Difficulty in prolapsing hard nucleus	32	14.1	<0.001
Excessive irrigation	21	9.3	<0.001
Increased maneuvering in anterior chamber	50	22.0	<0.001

Table 3: Compilation of post operative uncorrected visual acuity

Visual acuity	Day 1		Day 7		6^{th} week	
	N	%	N	%	N	%
<6/60	33	14.5%	5	2.2%	0	0%
6/24-6/36	91	40.1%	49	21.6%	15	6.6%
6/12-6/18	74	32.6%	62	27.3%	25	11.0%
6/6-6/9	29	12.8%	111	48.9%	187	82.4%

expensive modality of management in developing countries like India where cataract backlog is still a socioeconomic issue, making it difficult for the majority of the population to afford. MSICS guarantees the safety of this process in treating mature cataracts, with addition of dye.

As the tunnel construction and capsulorrhexis are shared by both phaco and MSICS, surgeons who have mastered one have a faster learning curve for the other. Therefore, MSICS is the ideal surgery for underdeveloped nations. It was promoted at the Aravind Eye Hospital in India and in Nepal for high-quality, high-volume cataract surgery. 227 cases who underwent SICS were included and monitored in this study for and postop corneal complications and also VA and followed up as mentioned earlier. There were no lost to follow up cases.

Of the 227 patients included, majority of patients were females contributing to 61% approximately that is similar to a study conducted by Warad et al in Jawaharlal Nehru medical college, Belgavi[10] in this study 63 (27.8%) subjects had complications and 164 (72.2%) subjects did not had complications in this study. Out of 63 subjects who had complications in which 36.5% of subjects who had corneal edema <10DM folds, 52.4% of subjects had corneal edema > 10DM folds, 15.8% of patients had striate keratopathy, and 1.6% of subjects had DM detachment.

OCTET grading was done for corneal edema patients on post op Day 1 and 6 patients (9.6%) had grade 1, 17 patients (27.4%) had grade 2 and 39 patients (63%) had grade 3. On 1^{st} week follow up, 19 patients had clear cornea, 5 patients (8%) had grade 1, 18 patients (29%) had grade 2, and 20 patients (32%) had grade 3. At the end of 6^{th} week postoperatively, 45 patients had clear cornea, and out of 18 patients who had corneal edema, 5 patients (8%) had grade 1, 6 patients (9.5%) had grade 2, and 7 patients (11.1%) had grade 3.

In this study, the most observed corneal complications were striate keratopathy and corneal edema. Most common risk factor that lead to these complications in this study was difficulty faced during prolapse of the hard nucleus and excessive irrigation which were similar in a study of Sudhakar J., et al. Rengaraj Venkatesh, et al.[11,12] This study also showed that corneal complications are due to increased maneuvering in anterior chamber and difficulty in prolapsing hard nucleus that is corelating with study done by Anjana et al., at Meenakshi medical college, Tamil Nadu.[13]

These complications would have been prevented by injecting high molecular weight viscoelastic to protect corneal endothelium, and decreased maneuvering in AC, wash of visco at end of surgery, proper cortical wash.

Study conducted by Kripalini et al., about corneal complications of SICS also had corneal complications and post-operative visual acuity similar to this study.[14]

According to World Health Organization, the quality indicator for cataract surgery is that 85% of the patients

Table 4: Comparison of corneal complications of present study with other studies

Complications	Nationalsurvey study	Sudhakar J et al	Rengaraj Venkatesh et al	Present Study
SK		7.3%		6%
Corneal edema	9.5%			24.5%
Corneal edema with <10 DM folds			7%	10%
Corneal edema with >10 DM folds			6%	14.5%
Descemet's detachment	0.1%			0.4%

Table 5: Comparison of BCVA at 6th week between various studies

BCVA end of 6^{th} week	Rengaraj Venkateshet al	Sudhakar J et al	Kripalni et al	Present study
6/6 – 6/9	94%	57.1%	89%	87%
6/12 – 6/18	5%	31.5%	9%	9%
6/24 – 6/36	1%	5.2%	2%	4%
<6/60	0	3.2%	0	0
No follow up	0	3.0%	0	0
Total	100%	100%	100%	100%

operated should have best corrected visual acuity of 6/18 or more[15] in this study, 96% of the patients had postoperative best corrected visual acuity of 6/18 or better.(Table 5)

Although small incision cataract surgery has corneal complications but they all are resolved within 2 weeks with proper management, and patients are most compliant with it than phacoemulsification due to its cost and less astigmatism as its suture less compared to older techniques.

5. Conclusion

The study conducted had majority of the patients of the age group 61-70 years and predominantly females were more i.e., 61%. According to cataract, majority of the patients as in 127 patients out of 227 patients had SIMC. Corneal edema was graded according to OCTET classification. At 6^{th} week postoperatively, corneal complications are less compared to post op Day 1. Visual rehabilitation was better with proper management of the complications by 2^{nd} week. These corneal complications would have been prevented by injecting high molecular weight viscoelastic to protect corneal endothelium, and decreased maneuvering in AC, wash of viscoelastic substance at the end of surgery, proper wash of cortical matter. Small incision cataract surgery is most cost-effective surgery if corneal endothelium is protected during surgery and will have early visual rehabilitation.

6. Source of Funding

None.

7. Conflict of Interest

There were no financial interest, no conflict of interest.

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