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Original Research Article

Demographic and clinical co-relations with outcomes of management of age-related cataract at a tertiary eye care centre in Western India

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Abstract

Background: Cataract is the leading cause of blindness in India and globally. Modern day cataract surgeries promise great visual outcomes and early rehabilitation to the patients. A prospective, longitudinal, institution-based cross-sectional study was conducted to analyse the visual outcomes and surgically induced astigmatism after phacoemulsification and manual small incision cataract surgeries. The impact of age, gender and rural/urban residence too was explored on the final visual outcome.

Aims and Objectives: The aim of the study was to examine the visual outcome and surgically induced astigmatism after phacoemulsification and manual small incision cataract surgery for age related cataract. The corelation of age, gender and geographic area of residence with the final visual outcome was also studied.

Materials and Methods: The study site was our regional institute of Ophthalmology in western India. The study period was one year from September 2021 to September 2022. The study included 204 eyes of 204 patients with visually significant cataract who were between 45 to 80 years of age and did not have complicated cataract or systemic and ocular co-morbidities. A thorough history taking and clinical examination were done. Patients were randomized to undergo cataract extraction via Phacoemulsification (PE) /Manual small incision cataract surgery (MSICS) along with intraocular lens implantation. 102 cases underwent PE and 102 patients were operated by MSICS. The postoperative visual outcomes were documented. The patients were followed up for six weeks.

Statistical Analysis: Statistical analysis was done using the SPSS (Statistical Package for Social Sciences) software version 29. A p value of less than 0.05 was taken as significant.

Results: There was no significant difference in the six-week postoperative BCVA between the phacoemulsification and MSICS groups. The phacoemulsification group had a significantly lesser surgically induced astigmatism and a better uncorrected visual acuity UCVA ($p<0.05$) at six weeks postoperatively as compared to the MSICS group. Increasing age and female gender ($p<0.05$) corelated significantly with a lower postoperative BCVA. Rural/urban residence did not significantly impact the postoperative BCVA.

Conclusion: Phacoemulsification and MSICS both give good visual outcomes after cataract surgery. Phacoemulsification may have an edge over MSICS in inducing less astigmatism and greater uncorrected visual acuity postoperatively. Increasing age and female gender appear to be linked to a lower postoperative BCVA.

Keywords: Age related cataract, Visual outcome, Demographic and clinical correlation.

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1. Introduction

Vision is a gift through which we can see this beautiful world. Cataract is one of the leading causes of avoidable blindness in India and the world.[1-3] Cataract extraction surgery followed by an intraocular lens implant is the treatment of this opacification of the crystalline lens. Phacoemulsification (PE) and manual small incision cataract surgery (MSICS) constitute the present-day armamentarium of cataract surgeries. Modern day cataract surgery offers a "vow" factor to the patients with great visual outcomes and early rehabilitation. Smaller sutureless incisions have faster wound healing and less surgically induced astigmatism. Independent studies have shown that age, gender, geographical location may affect the cataract surgical outcomes. The visual outcomes of MSICS and PE for age-related cataract have also been studied. Studies from western India which explore the association of these demographic and clinical variables with

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cataract surgical outcomes are few. Our study aims at evaluating the corelation of demographic and clinical factors (as age, gender, geographic area, type of surgery) with the visual outcomes. The study results would help enhance the quality of eye care services offered to cataract patients at our institute, strengthen our infrastructure, as well as help us prioritize the patient care as per the demographic variables.

2. Materials and Methods

The study was conducted at our tertiary eye care teaching institute affiliated to a medical college over a period of one year from September 2021 to September 2022. The study was a prospective, longitudinal, institution based, cross-sectional study. The study was approved by the Ethics committee at our Institute. Consecutive patients presenting to our outpatient department (OPD) with visually significant age-related cataract were enrolled in the study. All the study participants were informed of the study details and written consent was taken. **Figure 1** shows the workflow of the study. The average cataract cases per month per unit are around 60. Considering a recruitment period of four months with a 15% drop out /ineligibility rate the sample size was calculated as 204 eyes. The sample size was also calculated using a confidence interval of 90% and a 5% margin of error with a population proportion 0.5 and a population size of 720 (per year cataract surgeries per unit). The formula used for sample size calculation for the finite population is shown in **Figure 2**. The sample size was calculated to be 198 or above. Thus, we kept the sample size as 204 eyes. The criteria for inclusion in the study was set as an age of above 45 years, both genders, visually significant cataract, NS2+, NS3+ nuclear sclerosis, adequate pupillary dilatation ((at least 5mm) and patients willing to participate in the study and willing to give consent. Patients with NS4+, NS5+, brown cataract, mature, hypermature cataract, complicated cataract, co-existing co-morbidities as retinal detachment, uveitis, phacomorphic /phacolytic glaucoma, corneal opacity, traumatic cataract, subluxation of the crystalline lens were excluded from the study. Patients with diabetes, hypertension, thyroid abnormalities, history of alpha one adrenergic antagonist use and other systemic co-morbidities were also excluded from the study. At the time of presentation age, gender, address, presenting complaints, systemic and personal history were thoroughly documented. A complete examination of the eyes including visual acuity both uncorrected and best corrected, corneal curvature, astigmatism, anterior and posterior segment examination, refraction and intraocular pressure measurement was done. Cataract morphology and nuclear grading were noted at slit lamp bio-microscopy. Intraocular lens (IOL) powering was done. The patients were randomly allocated Phacoemulsification or MSICS with intraocular lens (IOL) implantation. Phacoemulsification is done by a sub 3mm incision and has the advantage of minimal surgically induced astigmatism and faster postoperative recovery. The disadvantage is in cases of higher grades of nucleus which may require higher energy and cause damage to the corneal endothelium. MSICS has the advantage of being safe in all grades of cataract however it has the disadvantage of a larger incision resulting in greater surgically induced astigmatism. A comparable number of surgeries 102 were allocated in each arm randomly. Computer generated random numbers were used for the randomization. Cataract surgery was done, under peribulbar anaesthesia with intraocular lens implantation and all the surgical steps were documented. A complete postoperative evaluation of all the patients was done. This included visual acuity, anterior/posterior segment examination at day one, one week, three weeks and six weeks after the operation. All patients were prescribed antibiotic-anti-inflammatory eye drops for minimum six weeks tapered as per the response. The patients were followed up for six weeks. Any intraoperative, post-operative complications were documented and managed. The visual outcome was taken as the uncorrected visual acuity (UCVA) and the best corrected visual acuity (BCVA) at six weeks postoperatively. Surgically induced astigmatism was also documented. The corelation of the visual outcomes with age, gender and rural /urban residence of the study participants was analysed.

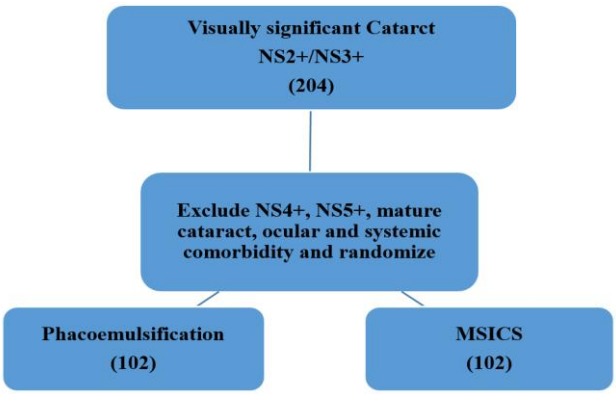

Figure 1: Workflow of the study

Unlimited population: $n = \frac{z^2 \times \hat{p}(1-\hat{p})}{\varepsilon^2}$

Finite population: $n' = \frac{n}{1+\frac{z^2 \times \hat{p}(1-\hat{p})}{\varepsilon^2 N}}$

Figure 2: Sample size calculation formulae

2.1. Statistical analysis

Statistical analysis was done using the SPSS (Statistical Package for Social Sciences) software version 29. Tables were constructed using the software. The arithmetic mean, standard deviation, percentages were used to present the results. Chi square test and the one-way repeated measures ANOVA calculators were used for the p value calculations. A p value of less than 0.05 was taken as significant.

3. Results

The study included 204 eyes of 204 patients. 59.76 years was the mean of the age of the study participants with a standard

deviation of seven. There were 90(44.12%) females and 114(55.89%) males. The geographical background of the cases was 126(61.77%) urban and 78(38.24%) rural. The breakup of the type of surgeries done was 102(50%) cases of phacoemulsification and 102 (50%) cases of MSICS. **Table 1** shows the comparison of BCVA in MSICS and phacoemulsification groups postoperatively. 91(89.22%) of 102 cases of MSICS had a six-week postoperative BCVA of 6/6-6/9. 93(91.18%) of phacoemulsification cases had a six-week postoperative BCVA of 6/6-6/9. The difference was not statistically significant at a p value of 0.63. **Table 2** shows the comparison of mean astigmatism in the two groups at six weeks. The mean SIA in the MSICS cases was -0.79±0.18 and in the phacoemulsification group was -0.50(+/-0.00). The difference was statistically significant at a p value of 0.01. **Figure 3** show the comparison of UCVA in MSICS and phacoemulsification groups at six weeks postoperatively. The p value was significant at a value of 0.02. **Figure 4**, **Figure 5** and **Figure 6** show the corelation of age, gender and geographic area with the six-week postoperative BCVA respectively. The corresponding p values were 0.03, 0.04 and 0.10 respectively.

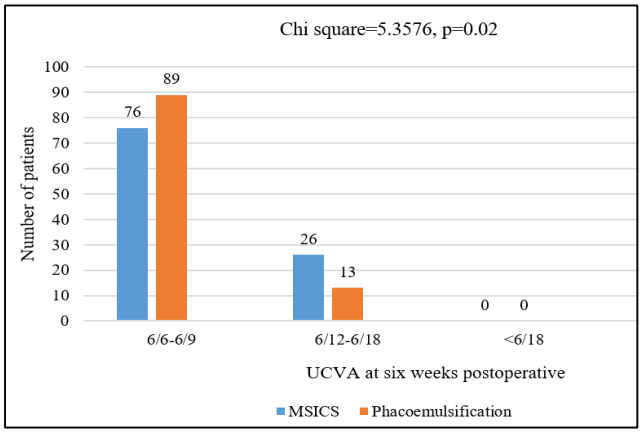

Figure 3: Comparison of six weeks postoperative UCVA between MSICS and Phacoemulsification groups

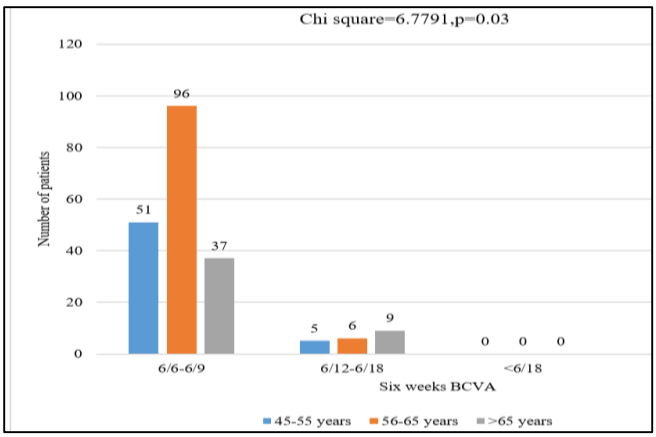

Figure 4: Corelation of age with postoperative BCVA at six weeks

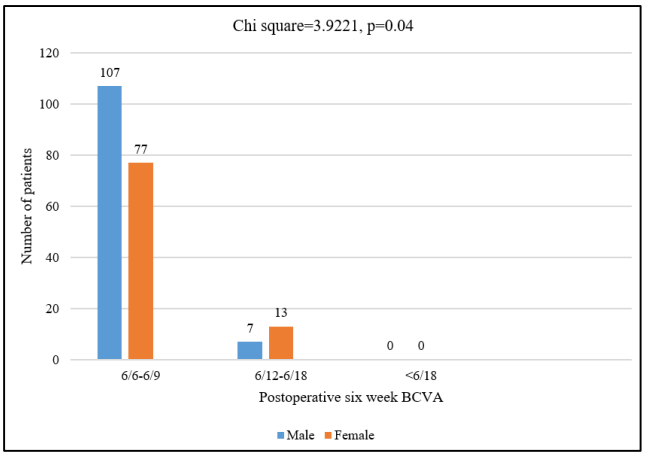

Figure 5: Corelation of gender with postoperative BCVA at six weeks

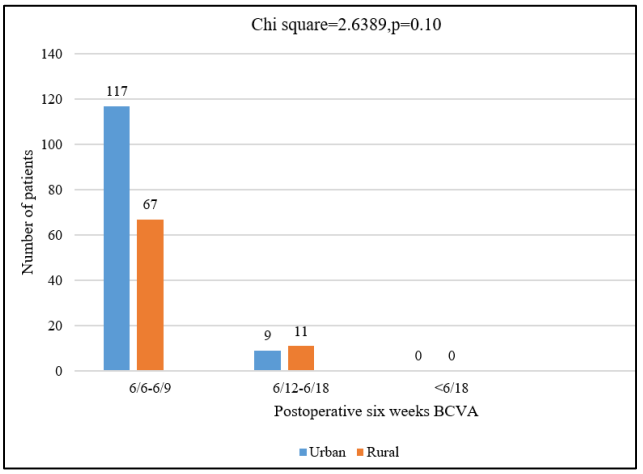

Figure 6: Corelation of geographic area with postoperative six weeks BCVA

Table 1: Comparison of BCVA in both groups at six weeks

Postoperative six weeks BCVA	MSICS Number (percentage)	Phacoemulsification Number (percentage)
6/6-6/9	91(89.22)	93(91.18)
6/12-6/18	11(10.78)	9(8.82)
<6/18	0(0)	0(0)
Total	102(100)	102(100)
Chi square=0.2217, p value=0.63		

Table 2: Comparison of mean astigmatism in the two groups at six weeks

	MSICS	Phacoemulsification
Mean SIA	-0.79	-0.50
Standard deviation	-0.18	-0.00
F-ratio=14.4117, p value=0.01		

4. Discussion

Our study was done with the aims and objectives of evaluating the demographic and clinical corelations (as age,

gender, geographic area and type of surgery) with the visual outcomes of cataract surgery. A total of 204 patients were recruited for the study. The mean age was 59.76±7.13 (Standard Deviation). There were 90(44.12%) females and 114(55.89%) males. The geographical background of the cases was 126 (61.77%) urban and 78 (38.24%) rural. We proceed to discuss the corelation of each factor with the visual outcomes of cataract surgery in detail.

4.1. Age

The six-week postoperative BCVA in our study had a significant co-relation with age at a p value of 0.03. Increasing age was associated with a lower BCVA. Hadas Ben Ei et al in their study on the impact of age and sex on cataract surgery complications and outcomes found a linear corelation between age and postoperative visual acuity.[4] X Li in their study on the corelation of age with the postoperative visual acuity after cataract surgery for age-related cataract found that good visual outcomes decrease significantly with aging.[5] This corelation may be explained by presence of aging changes in the macula, aging changes in the nervous system and a greater nuclear density with increasing age.[6,7] Dervenis N in his study on the visual outcomes after phacoemulsification surgery also found that increasing age was associated with worse visual outcomes.[8] Westcott MC in their study on the effect of age on cataract surgery visual outcome also reiterated age to be a significant factor in the postoperative visual acuity.[9]

4.2. Gender

In our study the six-week postoperative BCVA had a significant corelation with gender at a p value of 0.04 with females reporting a lower value of BCVA. H Ben Ei et al in their study reported that males had a better postoperative BCVA than females.[4] The post-surgery BCVA worsened with increasing age for both genders specially in the age group of 55-65 and 65-75 years. They observed these results were independent of risk factors and complications. They emphasized the role of psychological and subjective BCVA assessment in females to be an important factor in explaining a worse postoperative BCVA in the fair sex. Geiger MD et al explored the question "Are there sex-based disparities in cataract surgery?". They found no significant difference in the postoperative visual acuity between the two genders.[10] Lundqvist B reported on the gender related differences in cataract surgery outcomes over a period of five years.[11] They observed that females assess visual function worse than males (adjusting age and preoperative and postoperative visual acuity). This was true for both subjective (questionnaire) as well as objective (BCVA assessment on the Snellen's chart) visual function measures. The difference was significant in the immediate postoperative period but not after five years.

4.3. Geographic area

The geographical background of the cases was 126 (61.77%) urban and 78 (38.24%) rural. The difference in the six-week postoperative BCVA was not significant in the two groups at a p value of 0.10. Vijaya L reported on the outcomes of cataract surgery in rural and urban south Indian population.[12] In this cross-sectional population-based study at five urban divisions and 27 rural villages they found that aphakia, rural residence and visual acuity of <20/400 were associated with visual impairment. They observed the difference in the two regions was due to infrastructure and services in the rural areas which needed to be strengthened. In our study though the visual outcome was comparable in the rural and urban group, there was a lower percentage of rural (38%) patients operated at our centre located in urban division of western India. Marmamula S in their population based cross sectional study studied one urban and two rural locations.[13] They found that rural areas had a poorer visual outcome following cataract surgery. This could be attributed in a large part to the lack of refractive error correction post-surgery. They too reiterated the need to improve the services in the rural areas. Han X et al studied the outcomes of cataract surgery in a global perspective.[14] They did a systematic review of population based cross -sectional and longitudinal studies to explore the real-world outcomes of cataract surgery. They found a significant difference in the visual outcome and the leading causes of visual impairment after cataract surgery amongst different countries and geographic regions.

4.4. Type of surgery

91(89.22%) of 102 cases of MSICS had a six-week postoperative BCVA of 6/6-6/9. 93(91.18%) of phacoemulsification cases had a six-week postoperative BCVA of 6/6-6/9. The difference was not statistically significant at a p value of 0.63. The six-week postoperative UCVA in the MSICS group was 6/6-6/9 in 76(74.50 %) of 102 cases. In the phacoemulsification group the six-week UCVA of 6/6-6/9 was seen in 89(87.25%) of 102 cases. The difference was statistically significant at a p value of 0.02. The mean SIA in the MSICS cases was -0.79+/-0.18 and in the phacoemulsification group was -0.50(+/-0.00). The difference was statistically significant at a p value of 0.01. Zhang JY et al reported a meta-analysis of randomized controlled trials (RCT) of Phacoemulsification versus MSICS for age related cataract.[15] They analysed six RCTs including 1315 eyes. There was no statistically significant difference in the two groups for a BCVA of 6/9 or more, intraoperative and postoperative complications. They found that for a UCVA of 6/9 or more Phacoemulsification was statistically significantly superior to MSICS. There was significantly less SIA in the PE group as compared to the MSICS group. These findings were similar to our study. Dole K et al reported 310 patients done by Phacoemulsification (155) and MSICS (155) randomly.[16] They found no significant difference in mean corneal astigmatism, one-month BCVA and tear film function between the two groups.

A statistically significant difference was found between phacoemulsification and MSICS as per UCVA on postoperative day1, day 7 and day thirty. Cook C et al in their study in their study on PE versus MSICS in South Africa in 100 patients reported statistically significant better two-month UCVA and BCVA in PE group as compared to MSICS group. PE group also had a significant lower astigmatism at two months.[17] Thus the results of these studies were similar to ours in achieving a better postoperative UCVA in the Phacoemulsification cases as compared to MSICS. Few studies report no significant differences in postoperative visual outcomes between the two groups. Ruit S et al in their study of comparison of PE versus MSICS in Nepal reported 108 patients randomized to the two surgeries. The UCVA and BCVA at six months were comparable in both groups with no statistically significant difference.[18]

5. Strengths and limitations of the Study

The strength of the study lies in the fact that all patients were operated and followed up at a single centre of excellence. Thus, the institutional/infrastructure factors in service delivery were eliminated. Ocular and systemic known risk factors for poor surgical outcomes were excluded. Patients were randomized into the two surgical arms. Therefore, the demographic and surgical variables corelated independently with the visual outcomes. There are several limitations of this study. The study has a relatively small sample size. The follow-up period was six weeks hence the visual outcomes were not studied over a longer time-period. The study was a longitudinal study at a single centre thus selection bias could not be ruled out.

6. Conclusion

Phacoemulsification and MSICS both give good visual outcomes after cataract surgery. Phacoemulsification may have an edge over MSICS in inducing less astigmatism and greater uncorrected visual acuity postoperatively. Increasing age and female gender appear to be linked to a lower postoperative BCVA.

7. Source of Funding

None.

8. Conflict of Interest

None.

9. Ethical

Ethical No.: 18/2021.

10. Acknowledgement

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