

PRE- AND POST-OPERATIVE INTRAOCULAR PRESSURE VARIATION FOLLOWING CATARACT SURGERY AT A TERTIARY CARE CENTER IN KATHMANDU

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ABSTRACT

Manual small incision cataract surgery (MSICS) is the most practiced cataract surgery in low- and middle-income settings like Nepal. Intra-ocular pressure (IOP) can have an enormous effect on the visual outcome following cataract surgery. This study aimed to see the variation in intraocular pressure pre- and post-operatively following MSICS. This was a prospective hospital-based analytical study conducted at Nepal Medical College and Teaching Hospital from November 2021 to October 2022. A total of 57 patients undergoing MSICS were included in the study. IOP was measured with a Goldman's applanation tonometer pre-operatively and at the first and fourth week postoperatively. The study excluded glaucomatous patients. SPSS-16 was used to analyze the data. The mean pre-operative IOP was 13.81 ± 2.8 mmHg, followed by 12.77 ± 2.7 mmHg and 12.61 ± 2.4 mmHg respectively at the first and fourth weeks post-operatively. This decrease in IOP was statistically significant in both the first and fourth weeks. Higher pre-operative IOP and male gender were the factors significantly associated with IOP reduction at both the first and fourth weeks. Thus, MSICS has an IOP lowering effect which is more pronounced in males and patients with greater pre-operative IOP.

KEYWORDS

Cataract, cataract surgery, intra-ocular pressure (IOP), manual small incision cataract surgery (MSICS)

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INTRODUCTION

Cataract is the most important cause of blindness and visual impairment worldwide.¹ In Nepal, cataract remains the main cause of blindness accounting for 53.5% of cases followed by uncorrected refractory error 39.5% cases.² Various studies have reported either an increase or decrease in intra-ocular pressure (IOP) after cataract surgery.³⁻⁶ This will lead to the diminution of vision in spite of a good cataract surgery. These studies state that the change in IOP mainly depends upon the cataract surgical techniques.^{7,3} Manual small incision cataract surgery (MSICS) and phacoemulsification both have been shown to lower the IOP in various studies.⁸

MATERIALS AND METHODS

The primary objective was to evaluate variations in IOP preoperatively and postoperatively following manual small-MSICS at a tertiary care center in Kathmandu. Specific objectives included: (1) measuring and comparing pre- and post-MSICS IOP, (2) determining clinical characteristics and the range of IOP among patients undergoing MSICS, (3) assessing the relationship between IOP variation with age and sex, and (4) identifying the socio-demographic characteristics of patients. The study included all cataract patients undergoing MSICS. Patients with uncontrolled systemic diseases (e.g., diabetes mellitus, hypertension), phacolytic or phacomorphic glaucoma, or unwillingness to participate were excluded.

This was a prospective, hospital-based study conducted over one year, from November 2021 to October 2022, at Nepal Medical College Teaching Hospital (NMCTH). The sample size was calculated based on a cataract surgery prevalence of 84.6% in Nepal (Nepal Netra Jyoti Sangh, 2012).⁹ With a 95% confidence interval, a 10% margin of error, and using the formula $n = Z^2 \cdot P \cdot q / d^2$, the required sample size was 52.

Ethical approval was obtained from the Institutional Review Committee of NMCTH, and informed consent was secured from all participants. Data collection included a detailed history, visual acuity assessment using Snellen's chart, and comprehensive ophthalmological evaluation. IOP was measured preoperatively (one day before surgery) and postoperatively on days 7 and 30 using a Goldmann applanation tonometer. The standard technique was followed, ensuring patient comfort and safety, and topical antibiotics were instilled after each

measurement. Data were entered and analyzed using SPSS-16. Descriptive statistics such as frequency, mean, and standard deviation were calculated. Non-parametric tests were used to determine relationships between variables, with a p-value <0.05 considered statistically significant. Participants provided informed consent and were assured of their right to withdraw from the study at any time. Confidentiality of personal information was maintained throughout the study. The study was conducted following approval from the Institutional Review Committee of NMCTH (Ref. No.: ThesisProp 12-078/079).

RESULTS

The study included a total of 57 patients who underwent MSICS. The IOP variables (Preoperative IOP, 1st week IOP, 4th week IOP)

Table 1: Demographic and clinical characteristics of the study population

Variables	Categories	n	%
Age (Years); Mean: 66.7 Years (SD: 13.514), Median: 67, Range: 24–96	<40	2	3.5
	40-49	1	1.8
	50-59	14	24.6
	60-69	13	22.8
	70-79	16	28.1
	>80	11	19.3
Gender	Male	21	36.8
	Female	36	63.2
Religion	Hindu	32	56.1
	Buddhist	23	40.4
	Christian	2	3.5
Operating eye	Right	32	56.1
	Left	25	43.9
Unaided visual acuity	6/36 – 1/60	24	42.1
	Counting finger close to face	13	22.8
	Hand movement	12	21.1
	Perception of light (+)	8	14.0
Anterior segment	Corneal scar	3	5.3
	Brown cataract	6	10.5
	Hyper mature	2	3.5
Lens/cataract type	Immature senile Cataract	19	33.3
	Mature	29	50.9
	Polar	1	1.8
	Normal	13	22.8
Posterior segment	No view	37	64.9
	ARMD changes	1	1.8
	Hazy view	5	8.8
	Myopic fundus	1	1.8

Table 2: IOP measurements

Variables	Pre-operative IOP (mmHg)	1st Week Post-operative IOP (mmHg)	4th Week Post-operative IOP (mmHg)	Mean reduction in IOP (mmHg)	P-value
Overall IOP	13.81 (SD: 2.85)	12.77 (SD: 2.71)	12.61 (SD: 2.44)	1.017 (SD: 1.941) (1st week), 1.175 (SD: 2.196) (4th week)	<0.0001*
Gender					
Male	13.90	12.19	11.95	1.71 (1st week), 1.95 (4th week)	0.034** (1st week), 0.023** (4th week)
Female	13.72	13.11	13.00	0.61 (1st week), 0.72 (4th week)	

*Wilcoxon signed ranked test (Paired sample t-test), **Mann-Whitney Test

Table 3: Correlation of the pre-operative IOP with the IOP reduction in 1st and 4th-week postoperatively

Variables	IOP pre-operatively and IOP reduction in 1 week	IOP pre-operatively and IOP reduction in 4 weeks
Correlation coefficient (r)	0.44	0.58
P value*	0.000631**	0.000002**

*Spearman's Rho test

were not normally distributed as revealed by the Shapiro-Wilk test.

The mean age of the participants was 66.7 years (SD: 13.514), with a median age of 67 years (Range: 24–96). Most participants (72.8%) were aged 60 years or older, and females constituted 63.2% of the study population. The majority were Hindu (56.1%), followed by Buddhists (40.4%) and Christians (3.5%). More than half of the surgeries were performed on the right eye (56.1%). The most common unaided visual acuity was 6/36–1/60 (42.1%), followed by counting fingers close to the face (22.8%). Mature cataracts were the most prevalent type (50.9%), and in 64.9% of cases, the posterior segment was not visible due to hazy media (Table 1).

The mean preoperative IOP was 13.81 mmHg (SD: 2.85), which decreased to 12.77 mmHg (SD: 2.71) at one week postoperatively and 12.61 mmHg (SD: 2.44) at four weeks postoperatively. However, there was a greater reduction in IOP in males as compared to females at both 1st and 4th weeks. The pre-operative IOP was higher among younger age groups (<49 years). On comparing the IOP mean values preoperatively and 1st week postoperatively, there was a decrease in IOP in 1st week with a mean reduction in

IOP of 1.017±1.941 and this was statistically significant. On comparing the IOP mean values preoperatively and 4th week postoperatively, there was a decrease in IOP in 4th week with a mean reduction in IOP of 1.175±2.196 and this was statistically significant. There was a significant difference in IOP reduction among men and women statistically significant. Thus, men had a significantly greater IOP reduction after surgery than women at both 1st and 4th weeks (Table 2).

There was a positive and moderately strong correlation between IOP pre-operatively and IOP reduction 1st and 4th week postoperatively which was statistically significant. There was a positive correlation between pre-operative IOP and IOP reduction in 1st week post-operatively (r=0.44). There was a positive correlation between pre-operative IOP and IOP reduction at 4th week post-operatively (r=0.58) (Table 3).

DISCUSSION

This study longitudinally measured the post-operative IOP at one week and one month. Several other studies have prospectively measured the post-operative IOPs at various time durations ranging from hours to days to

months.¹⁰⁻¹² The total sample in our study was 57 which is comparable to other similar studies of IOP and MSICS.⁴ In this study, the mean age of the study population was 66.7 ± 13.51 years and two-third of the study population were female. This finding of age and gender distribution is comparable to other similar studies by Jacob *et al*,⁴ Sharma and Madhvi,¹³ Rainer *et al*,¹² and Lv *et al*.¹⁰ The right eye and left eyes were almost equally operated on in this study, which is similar to the study by Jacob *et al*.⁴ The most common type of cataract was mature which might be due to the late presentation of the cases for intervention in our settings. This may be the reason for poor visualization of the posterior segment in a majority of the cases. However, we didn't find many studies on IOP and cataract surgery elaborating on the operated eye and findings of anterior and posterior segments. The mean preoperative IOP was greater in studies by Zetterstrom *et al*⁵ (15.98 mmHg), Ngang *et al*¹⁴ (15.61 mmHg), and Jacob *et al*⁴ (15.16 mmHg) than our finding (13.81 ± 2.850 mmHg). This might be due to these studies including patients with preexisting glaucoma which our study had excluded. In this study, the pre-operative IOP was greater in males than that of females but the post-operative IOP was greater in females at both the 1st and 4th week. This finding is in contrast to the findings of Lv *et al*¹⁰ and Zetterstorm *et al*⁵ who found that females had a higher preoperative IOP than males and greater post-operative reductions.

Studies by Jacob *et al*,⁴ Das *et al*,¹¹ Ngang *et al*,¹⁴ and Lv *et al*,¹⁰ also found a statistically significant reduction in IOP following MSICS. The mean reduction of IOP in our study at 1st week and 4th-week post operatively were 1.01 ± 1.941 mmHg and 1.17 ± 2.196 mmHg, respectively. This was comparable to the study by Zetterstrom *et al*⁵ who found a mean reduction in IOP of 1.46 mmHg. This finding was different from studies by Das *et al*¹¹ and Ngang *et al*¹⁴ who found higher mean reductions of 3.29 mmHg and 3.16 mmHg respectively of IOP following MSICS which might be due to higher pre-operative IOP levels. In contrast to our finding, studies by Rainer *et al*⁶ 2001 and Rainer *et al*¹² 2007 found an increase in IOP in the immediate post-operative period following MSICS. The authors explained that the early postoperative spikes in IOP might have occurred due to the use of ocular visco-elastic agents. Although visco-elastic agents were also used in our study we didn't examine IOP at the early post-operative periods (up to 24 hours). Our finding of higher preoperative IOP having greater reductions in post-operative periods corresponds with the studies of Mansberger *et al*,¹⁵ Zetterstrom *et al*,⁵

and Slaubaugh *et al*.¹⁶ Interestingly, Slaubaugh *et al*¹⁶ found that pre-operative IOPs in the lower range had the post-operative IOPs unchanged or ever higher following cataract surgery.

Sengupta *et al*¹⁷ compared IOP reduction after phacoemulsification with MSICS and they concluded both phacoemulsification and MSICS led to significant and equivalent IOP reduction 6 months after surgery. Likewise, a study comparing post-operative changes in IOP between SICS and CECS found a significant decrease in IOP in both the groups at 1st week but there was a rise in IOP in the CECS group at 3 months.¹³ Thus, post-operative IOP reduction was seen not only following MSICS but also discovered in other cataract surgeries like phacoemulsification and CECS. Among other factors affecting IOP reductions is the axial length of the eye. The reduction in IOP was greater in cases with shorter eyes than in longer eyes following cataract surgery.⁵ However, our study didn't include this parameter in our patients. There are many reasons identified for a decrease in IOP following cataract surgery. Some of these explanations include improvement in aqueous outflow, resolution of inflammation, clearance of viscoelastic material from the anterior chamber, reduction in aqueous humor production, and aqueous leakage through the tunnel.^{3,4,15,18-21}

In conclusion, there was a significant reduction in the IOP at 1st week and 4th week after MSICS even in non-glaucomatous patients. Higher pre-operative IOP and male gender were significantly associated with IOP reduction after MSICS.

Limitations: The sample size was relatively small and the duration of the postoperative follow-up was short. A longer follow-up can be more useful for the evaluation of IOP change. There is a normal diurnal variation of IOP. However, our study didn't account for this entity to measure the IOPs. This study didn't measure the IOP changes during the early post-operative periods (up to 24 hours) where the chances of changing IOP remain high.

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