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ANALYSIS OF POST MSICS IOP RISE WITH 2%HPMC AND 1% SODIUM HYALURONATE OVDs - a comparative study

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ABSTRACT **Background.** Elevated IOP is the most frequent postoperative complication after cataract surgery and consequences of raised IOP lead to sight threatening problem. Intraocular pressure spikes of 30 mm HG or higher in the early period after cataract surgery causes pain, corneal epithelial edema, and damage to optic disc. The main cause of postoperative IOP increase is that the viscoelastic agent remains in the eye, which causes a mechanical obstruction of trabecular meshwork .**Aims and objectives.** To compare the effect of two OVDs (2% HPMC and 1% Sodium Hyaluronate) on Intraocular pressure after MSICS. **Study design.** This is a prospective observational study of 8 months duration in a tertiary hospital of Eastern India.**Methods.** 100 consecutive patients above the age 50 years having age related cataract planned for elective cataract surgery will be included in this study. 50 consecutive patients were assigned to receive Hydroxypropyl methylcellulose(2%) and remaining 50 patients were assigned to receive Sodium hyaluronate (1%) during surgery. The IOP was measured 6 hours,24 hours and 1 week after surgery and the findings were noted. After the study period the collected data was analyzed by standard statistical tools. **Results**.Mean IOP increased by 4.08 mm of Hg in the group receiving 2% HPMC and by 8.2 mm of Hg in patients receiving 1% Sodium Hyaluronate. In both HPMC and Sodium Hyaluronate group the rise of the IOP in 6 hour post operative period was found to be significantly higher ($p<0.05$) than the pre operative IOP value. But the post operative 6 hour mean IOP rise was 4.32 mmHg more in the Sodium Hyaluronate group(8.2mm Hg) than the HPMC group (4.08 mmHg) . 24 hours and 1 week post-operatively the rise in mean IOP was found to be not significantly different from each other. **Conclusion :** These findings indicate that 1% Sodium Hyaluronate causes a significantly higher IOP rise than 2% HPMC in the early post operative period.But 24 hours and 1 week post-operatively the rise in mean IOP was insignificant in both the group.

KEYWORDS :

INTRODUCTION :

Elevated IOP following cataract surgery has been documented in 1950s. Application of viscosurgical devices has improved quality of anterior chamber surgery [4] . A stable anterior chamber is advantageous in cataract surgery. The major aim of the application of OVD in cataract surgery is prevention of corneal endothelial loss. Maintaining of the anterior chamber, mechanical protection of the corneal endothelium against surgical trauma, absorption of ultrasound energy, coating of intraocular lens and facilitation of the surgical procedure during anterior chamber surgery and intraocular lens (IOL) implantation are the most important advantages of these agents [5] . The cause of the elevated IOP are likely multifactorial. Other contributing factors include a pre-existing compromise of outflow facility of trabecular meshwork, retained ocular viscosurgical devices (OVDs), surgical trauma, watertight wound closure, retained debris of lens, release of iris pigment, hyphema and inflammation are also thought to be contributing factors for elevation of IOP [6] . The skilfulness of the surgeon has been implicated as well. Increased surgical experience is corrected with a decreased risk of ocular hypertension following cataract extraction [6]. Berson et al [7] reported that sodium hyaluronate causes a substantial decrease (55 to 60) in the outflow of aqueous humour when injected into the anterior chamber. Subsequently it has become well accepted that retained viscoelastic materials inhibit aqueous outflow and results in increased IOP . Arshinoff [8] concluded that, if no OVD is retained in anterior chamber , however, then increase in IOP following cataract surgery are of no greater severity or duration than if no OVD has been used at all. Ermis SS et I[9] observed an elevated IOP was transient and benign in a 630 cases of cataract extraction with IOL implantation. He also compared the effects of travoprost and brinzolamide on intraocular pressure in a patient undergone cataract surgery with Phecoemulsification method concluded that some individual experienced pain, corneal oedema, glaucomatous nerve damage, or anterior ischemic optic neuropathy [9]. Hildebrand GD et al[6] observed in a study that elevated IOP is the most frequent post operative complication demanding treatment following Phecoemulsification . As many as 18 to 45 of patients may experience an IOP greater than 28 mmHg following Phecoemulsification , but most pressure returned to normal by 24 hours postoperatively. The peak most commonly occur 8 – 12 hours after surgery and only 1.3 to 10.0 of case record an IOP higher than 30 mmHg 24 hours postoperatively. After uneventful Phecoemulsification in eyes without glaucoma, however, IOP spikes may reach 68 mmHg.

OVDs are generally classified according to their molecular weight and viscosity. Cohesive agents are more viscous than dispersive OVDs and they have high molecular weights and longer molecular chains. These properties make cohesive OVDs an excellent choice for maintaining space, stabilizing tissues, and opposing the posterior pressure that occurs during cataract extraction. The particles of low viscosity OVDs are considered dispersive, because they do not adhere to one another like they do in high viscosity OVDs. Dispersive viscoelastics are able high viscosity OVDs to protect individual structures in the anterior chamber such as the corneal endothelium [9] . Because of their dispersive nature , however , low viscosity OVDs are generally more difficult to remove from the eye completely.

METHODOLOGY :

This is a prospective observational study of 8 months duration from from April 2020 to December 2020 done in a tertiary care hospital of Kolkata, West Bengal. All the patients were above the age of 50 years in the ophthalmology OPD having age related cataract without any ocular or systemic morbidity having no previous history of ocular surgery planned for elective MSICS after fulfilling the inclusion and exclusion criteria will be included in this study. Total 100 eyes of 100 consecutive patients having senile cataract scheduled for elective manual small incision cataract surgery (MSICS) and implantation of an intraocular lens(IOL). 100 eyes of 100 patients were divided into two groups of which Group1 include 50 eyes(50 patients) and Group 2 include 50 eyes(50 patients). The study protocol was approved by ethics committee. Exclusion criteria were previous ocular surgery, ocular hypertension(pre operative IOP>22 mmHg), primary and secondary glaucoma, corneal and retinal pathology, patients unwilling to give consent . All patients undergoing cataract surgery following investigations were done preoperatively - fasting and post prandial blood sugar, blood pressure, tonometry, syringing of nasolacrimal duct, biometry, slit lamp biomicroscopy, USG – B scan, ECG. The variable in this study were - 1) Patient particulars in terms of age, sex, duration of disease 2) Visual acuity , intraocular pressure measurements at the day before surgery , after 6 hours,24 hours and 1 week of MSICS in both the groups. Group 1 assigned to receive 2% hydroxyl propyl methyl cellose and Group 2 assigned to receive 1% sodium hyaluronate. All patients were operated by same surgeon. Approximately 1-2 hours before surgery eye drop Tropicacyl plus was given in the operated eye. After peribalbar anaesthesia MSICS with PMMA posterior chamber intra ocular lens(PCIOL) insertion was

performed with a scleral tunnel incision of 6-8 mm and a side port of 1 mm. Assigned OVDs were used during surgery. The baseline IOP was measured by Goldmann applanation tonometer on the day before surgery. The IOP was again measured with the same Goldmann applanation tonometer 6 hours, 24 hours and 1week after surgery. The Ophthalmologist who measured the IOP was masked to the group assignment. Group comparisons of the preoperative and post operative IOP and of the mean IOP changes from preoperatively to 6 hour, 24 hours and 1 week post operatively were made with paired t test. Preoperative values were compaired with after 6 hours, 24 hours and 1 week separately for each group also using paired t test.

RESULTS

Table 1 shows the mean preoperative and postoperative IOP. There was no significant group difference in preoperative IOP. At 6 hours post operatively, the mean IOP was significantly higher in 1% SODIUM HYALURONATE group than 2% HPMC group. At 24 hours and at 1 week postoperatively, there was no significant group difference in mean IOP. Mean IOP changes from preoperatively to 6 hours, 24 hours , and 1 week post operatively are listed in table 2 . at 6 hours mean IOP increased significantly in both groups. At 24 hours and at 1 week there was no significant change in either group. Figure 1 compares the mean IOP changes in the two groups. Figure 2 shows mean IOP increased by 4.08 mm of Hg in the group receiving 2% HPMC and by 8.2 mm of Hg in patients receiving 1% Sodium Hyaluronate. In both HPMC and Sodium Hyaluronate group the rise of the IOP in 6 hour post operative period was found to be significantly higher ($p<0.05$) than the pre operative IOP value. But the post operative 6 hour mean IOP rise was 4.32 mmHg more in the Sodium Hyaluronate group(8.2mm Hg) than the HPMC group (4.08 mmHg) . 24 hours and 1 week post-operatively the rise in mean IOP was found to be not significantly different from each other.

Table 1 : Pre operative and post operative mean IOP and P value

TIME	2% HPMC	1% SO-HYALURONATE	P VALUE
PRE-OP MEAN IOP	14.08	14.28	
6 HRS POST-OP MEAN IOP	18.16	22.48	<0.01
24 HRS POST-OP MEAN IOP	14.6	14.92	0.07
1 WK POST-OP MEAN IOP	13.64	13.76	0.09

Table 2 : Post operative mean IOP change(mmHg) in 2% HPMC and 1% SODIUM HYALURONATE

TIME	2% HPMC	1% SODIUM HYALURONATE
6 HRS POST-OP	4.08	8.2
24 HRS POST-OP	0.52	0.64
1 WK POST-OP	-0.32	-0.52

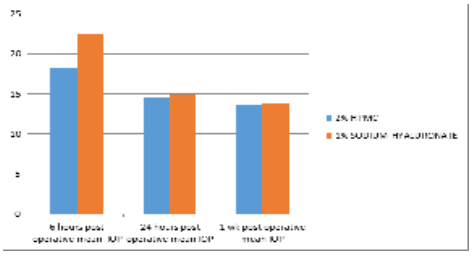

Figure1: Comparison of post operative mean IOP with 2% HPMC and 1% SODIUM HYALURONATE

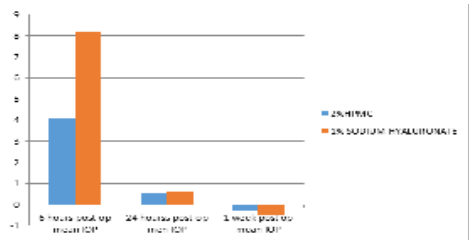

Figure 2:Comparison of mean IOP change(mmHg) with 2% HPMC and 1% SODIUM HYALURONATE

DISCUSSION

OVDs are widely used in small incision cataract surgery. OVD has several advantages specially dispersive viscoelastic agents thought to protect corneal endothelium from extensive damage during cataract surgery. However viscoelastic agents have the disadvantage of causing an increase in IOP. This has become a major concern, since an increasing number of cataract surgeries is performed on an outpatient basis and patients are often discharged shortly after surgery. In this study we evaluated the effect of two commonly used viscoelastic agent, 2%HPMC and 1% SODIUM HYALURONATE on the IOP after MSICS.

Our findings indicate that in the early post operative period after MSICS 1% SODIUM HYALURONATE causes a significantly higher IOP rise than 2% HPMC. At 6 hours postoperatively, the mean IOP increased by about 8.2 mm Hg in the 1% SODIUM HYALURONATE group and by about 4.08 mm Hg in the 2%HPMC group. However, in this study no IOP lowering medication was given at the end of surgery. The fact that both viscoelastic agents caused a significant IOP increase, argues for a prophylactic use of IOP lowering medication. In a previous study 8 compared the effect of Healon5, a cohesive viscoelastic agent, and Viscoat on postoperative IOP after small incision cataract surgery which was performed by the same surgeon. Articles reporting the effect of viscoat or ocucoat on post operative IOP used in manual extracapsular cataract extraction(ECCE)10-16 or phecoemulsification cataract surgery with a 7 mm incision3 17. In two further studies antiglaucomatous agents were used the IOP was measured at 1 day postoperatively18 19. However, these reports are difficult to compare and often contradictory, since the postoperative IOP varies interindividually and with the surgical technique.

The mechanism of postoperative IOP increase is yet to be understood. A reason for the postoperative IOP increase seems to be the amount of the remaining OVD at the end of surgery. It is assumed that the remaining OVD mechanically obstructs the trabecular outflow pathway and hence decreases the outflow facility4. In order to avoid a postoperative IOP increase, a thorough removal of OVD is vital. Surgical techniques for the removal of viscoelastic substances, especially from behind the IOL, have been described20-22 but a complete prevention of a postoperative IOP increase could not be achieved with any technique. In our study, both 2%HPMC and 1% SODIUM HYALURONATE were equally removed with great care from the anterior chamber as well as from behind the IOL at the end of the surgery. However, it was nearly impossible to completely remove both viscoelastic agents without injuring the endothelium and other vulnerable structures of the eye. Assuming that the amounts of the remaining viscoelastic substances were similar in our study, the difference in postoperative IOP increase between the two viscoelastic agents might be explained by differences in their bio- physical properties. The clearance of the viscoelastic agent through the trabecular mesh- work is believed to be dependent upon the viscosity and molecular weight of the used materials11. Theoretically, the lower the viscosity and the molecular weight of the viscoelastic agent, the faster is the clearance through the trabecular meshwork. In accordance with this theory, in our study 2%HPMC which is less viscous and has a lower molecular weight than 1%SODIUM HYALURONATE caused less IOP increase. The lower viscosity of 2%HPMC compared with 1%SODIUM HYALURONATE, may, however, have the disadvantage of poorer endothelial cell protection.

CONCLUSION

Our study shows that in the early postoperative period(6 hours) after manual small incision cataract surgery 1% SODIUM HYALURONATE caused a significantly higher IOP increase than 2%HPMC. But 24 hours and 1 week after surgery there was no significant changes in IOP in both the groups. Although the viscoelastic agents were removed thoroughly, both 2%HPMC and 1% SODIUM HYALURONATE caused a significant IOP increase compared with the preoperative IOP. Therefore IOP monitoring is necessary after small incision cataract surgery, and the use of IOP lowering medications is recommended, particularly in patients with compromised optic discs.

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