ORIGINAL ARTICLE

Effect of Peroperative Use of Heparinised Irrigating Solution on Postoperative Inflammation in Phacoemulsification

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Abstract:

Objective: To evaluate the effect of Heparin Sodium on postoperative inflammation following cataract surgery in adults.

Methods: A Quasi experimental study was conducted at Fauji Foundation Hospital, Rawalpindi during May to October 2023 which include one twenty (120) cases diagnosed with uncomplicated cataracts booked for phacoemulsification were randomized to Group 1 (heparinized solution) and Group 2 (Standard irrigating solution) using lottery method. Surgery was performed by single surgeon as per standard protocols. Patients were assessed preoperative and post-operative on day 1, day 7 and day 28 for visual acuity, intraocular pressure and detailed slit lamp examination to measure the AC cellular activity and AC flare in for all cases. SPSS-26 was used. Mean and standard deviations were computed for quantitative data, whereas, frequency and percentages were computed for qualitative data. The independent t-test was used to compare quantitative variables, while the chi-square/fisher exact test was used to evaluate qualitative variables. A P-value $\leq$ 0.05 was deemed as significant.

Results: The mean age of patients in the group 1 and group 2 were of 64.71$\pm$9.69 years and 68.45$\pm$9.69 years respectively. In both groups, most of the patients were female. However, no significant difference found in both groups in terms of baseline data. Significant difference in IOP, AC-cells and AC-flare was observed on day-1, day-7 and day-28 between both groups, as p-value was < 0.05.

Conclusion: The study concluded that using heparin sodium as an anti-inflammatory drug could be effective in lowering post-operative inflammatory reaction. *Al-Shifa Journal of Ophthalmology 2025; 21(2): 50-55.*

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Introduction:

Recent estimates indicate that the prevalence of adult blindness is approximately 0.6% worldwide and 2.7% in Pakistan. Approximately 80% of these instances can be avoided.[1] One of the leading causes of reversible blindness worldwide is cataract, and cataract surgery accounts for a significant portion of each ophthalmic units' workload.[2] The ophthalmology community is debating the benefits and drawbacks of various procedures, including phacoemulsification, extra capsular cataract extraction, and manual suture-less cataract extraction. However, there is general agreement that all procedures should have minimal postoperative inflammation following surgery.[3]

One major factor contributing to delayed vision recovery following cataract surgery

is postoperative inflammation. Another consequence to which eyes with an elevated inflammatory response are vulnerable is cystoid macular edema, which may or may not lead to irreversible vision loss[4.] Additionally, eyes with an inflammatory reaction are more likely to experience posterior capsular opacification, a delayed postoperative consequence.[5] Over 50 years after the first intraocular lens (IOL) was implanted, research is still being conducted to make the IOLs more biocompatible and reduce postoperative inflammation.[6]

Because of its anti-inflammatory qualities, heparin is utilized in pediatric cataract surgery as coatings for intraocular lenses and as irrigating solutions to lessen inflammation after surgery.[7] Heparin possesses anti-proliferative and anti-inflammatory properties. Apart from its anticoagulant properties, heparin has been demonstrated to suppress fibroblast activity and prevent fibrin formation following eye surgery.[8]There is less post-operative inflammation in eyes implanted with heparin-coated lenses, according to a few studies.[9,10] Nevertheless, no comparable research has been reported in the Pakistani community, which is known to have darker skin and be more susceptible to post-operative inflammation.[10] In this study, we assessed how adding heparin sodium to the irrigating solution during cataract surgery affected the procedure.

Methodology:

This Quasi experimental study was conducted in the department of ophthalmology at Fauji Foundation hospital, Rawalpindi, from May to October 2023 after the approval of research protocol from Ethical Review Committee of the hospital [No. 685/RC/FFH/RWP]. Using a consecutive non-probability sampling technique, 120 cases of either gender, older than 50, with simple cataracts who were scheduled for phacoemulsification were chosen. All patients had good glycemic and hypertensive control. They were given a hospital number, and the procedure was performed with their informed consent. Preoperative examinations include visual acuity assessment by Log Mar chart, intraocular pressure measurement by Goldman's applanation tonometry, detailed slit lamp examination carried out to measure the AC cellular activity and AC flare were carried out for all cases. Exclusion criteria were history of ocular pathology like advanced glaucoma, uveitis, high myopia, pseudo exfoliation, complicated cataracts, subluxated lens, previous ocular surgery, severe diabetic retinopathy, Fuchs' endothelial dystrophy and any ocular surface disease. Brunescent cataracts were also excluded because of prolonged surgical time. Patients were randomized to group 1 (heparinized solution) and group 2 (Standard irrigating solution) using lottery method. Patients allocated to group 1 received anterior chamber irrigation with heparin sodium (10IU/1ml) in standard irrigating solutions during phacoemulsification and group 2 received standard irrigating solutions. All procedures were carried out by a single surgeon using topical anesthetic and the conventional phacoemulsification technique. All cases were uneventful. At the conclusion of the procedure, hydrophobic acrylic foldable intraocular lenses were placed in each patient. Postoperatively, potent topical antibiotic drops were prescribed along with Prednisolone acetate 1% eye drops six times a day for 4 weeks. Patients were assessed pre-operatively and postoperatively on day 1, day 7 and day 28 which included VA, IOP, AC cellular activity and AC-flare as per method as mentioned above. According to SUN (standardization of uveitis nomenclature), anterior chamber flare was evaluated as follows: 0 = no flare, 1 = mild and barely perceptible flare, 2 = moderate flare with clear iris details, 3 = noticeable flare with blurry iris details, and 4 = extreme flare with severe fibrinous exudates per high-power field. AC Cellular activity was graded as: 0 = <1 cell, +0.5= 1-5 cells, +1=

6-15 cells, +2= 16-25cells, +3= 26-50 cells, +4= >50 cells per high power field as per SUN. During each visit, three measurements were taken to determine the degree of anterior chamber inflammation, and the average of these measurements was noted as the final value. All readings were taken by single observer to prevent interobserver variability. Data was entered and analyzed with the help of SPSS-26. Mean and Standard Deviation was calculated for quantitative variables while, frequency and percentages were calculated for qualitative variables. Qualitative variables were compared using chi-square/Fisher's exact test and quantitative variables were compared using independent t-test. A P-value $\leq$ 0.05 was considered as significant and confidence intervals at 95% were calculated.

Results:

There were 120 patients in all (60 in the group 1 and 60 in the group 2). Patients in the group 1 were 64.71±9.69 years old, whereas those in the group 2 were 68.45±9.69 years old. The majority of patients in both groups suffered from hypertension and diabetes. Since the p-value was more than 0.05, there was no significant difference between the two groups in terms of baseline data, as shown in table 1.

Table 1: Baseline data of the Patients

Baseline Data	Group 1	Group 2	P-value
Age (mean $\pm$ SD)	64.71$\pm$9.69	68.45$\pm$9.69	0.528
Gender n(%) • Male • Female	 04 (6.6%) 56 (93.3%)	 2 (3.3%) 58 (96.6%)	 0.402
Co-morbid (%) • Diabetes Mellitus • Hypertension • Ischemic heart disease • DM & HTN • DM, HTN & IHD	 11 (18.3%) 16 (26.6%) 05 (8.3%) 16 (26.6%) 02 (3.3%)	 10 (16.6%) 14 (23.3%) 04 (6.6%) 17 (28.3%) 03 (5%)	 0.97

None of the patients experienced any intraoperative complications. The p-value was less than 0.05, indicating a significant difference between the two groups on days 1, 7, and 28. Further, there was no significant difference in VA between group 1 and group 2 pre-operatively and postoperatively (day-28), as shown in table 2 and figure 1.

Table 2: Anterior Chamber Cellular Activity in the Study and Control Groups

Follow-up	Parameters	Groups		P-value	95% Confidence	
		Study Group	Control Group		Lower limit	Upper limit
Pre-Operative	VA IOP AC-Cells AC-Flare	0.8± 0.25 13.98 ± 2.87 0.03 ± 0.18 0	0.8± 0.21 13.183 ± 2.87 0 0.05 ± 2.2	0.752 0.075 0.156 0.081	-0.070 -0.083 -0.12 -0.106	0.096 1.68 0.079 0.006
Day-1	IOP AC-Cells AC-Flare	13.06 ± 4.41 0.62±0.39 0.60 ± 0.49	13.08 ±4.42 2.49 ± 0.56 1.08 ± 0.46	0.985 0.000 0.000	-1.75 -2.05 -0.65	1.71 -1.69 -0.310
Day-7	IOP AC-Cells AC-Flare	13.28 ± 3.40 0.44 ± 0.73 0.433± 0.49	13.43 ±3.22 1.56± 0.61 0.69 ± 0.46	0.805 0.000 0.044	-1.34 -1.36 -0.43	1.04 -0.88 -0.084
Day-28	VA IOP AC-Cells AC-Flare	0.2± 0.13 11.83 ± 2.56 0.22 ± 0.40 0.433± 0.49	0.2± 0.09 13.28 ± 3.54 0.80 ±0.61 0.69±0.46	0.810 0.013 0.000 0.000	-2.5 -0.258 -0.762 -0.39	0.036 -0.317 -0.38 -0.15

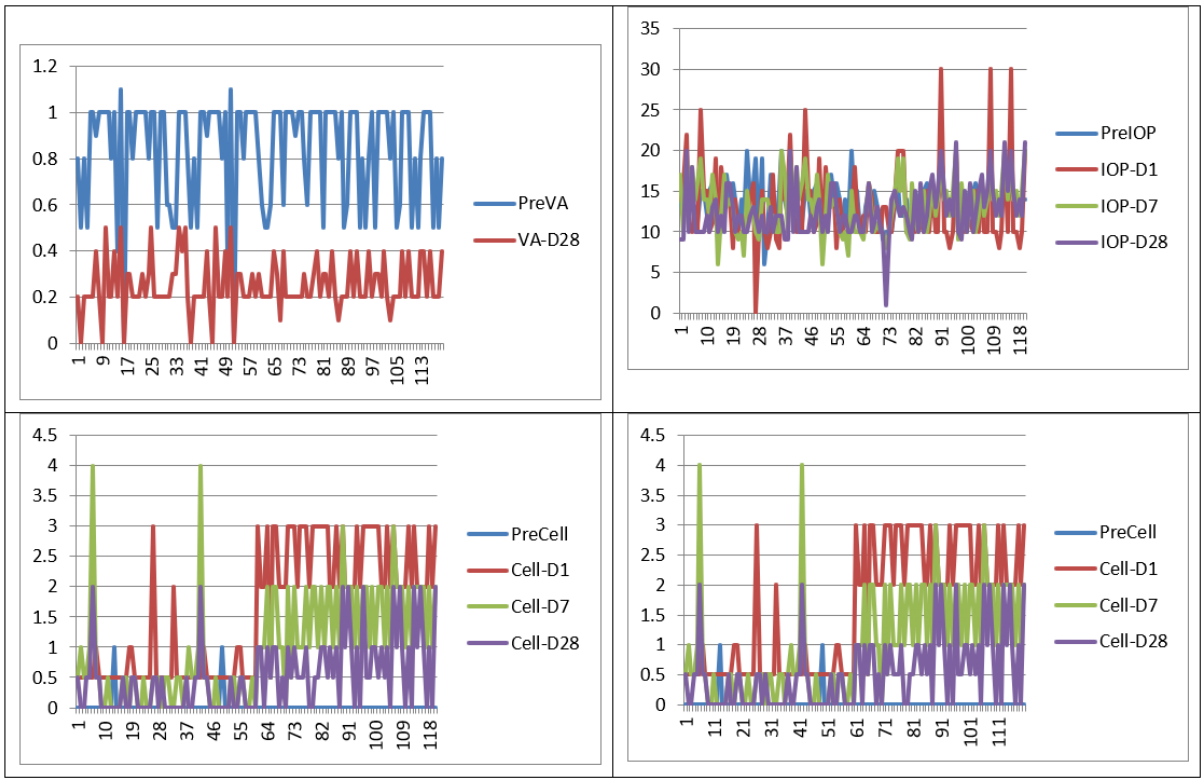

Figure 1: Anterior Chamber Cellular Activity in the Study and Control Groups

Discussion:

Globally, age-related cataracts are the most common cause of progressive visual loss. Worldwide, cataract surgery accounts for the majority of eye units' workload and is a significant medical expense. In terms of improved quality of life, it is among the most economical public health interventions.[11] The key factors influencing the success of contemporary cataract surgery are vision quality and early visual rehabilitation. These two metrics are thereafter reliant on post-operative inflammation and surgical procedure problems.[12]

The coagulation and fibrinolytic pathway may be disrupted by any abnormality in the blood–aqueous barrier, which could be brought on by intraocular inflammation, high intraocular pressure (IOP) prior to surgery, or severe eye manipulation during surgery.[13]

It has been suggested that heparin is a good option for lowering the inflammatory response following cataract surgery. Heparin-coated IOLs and heparin solution added to irrigating solutions during phacoemulsification are two examples of its use. During phacoemulsification, we added 10 IU/ml of heparin sodium to a balanced salt solution for irrigation. An irrigating solution without heparin was used during surgery on a parallel group of patients. Visual acuity, intraocular pressure, AC-cells, and AC-flare did not differ significantly before surgery; however, we discovered a statistically significant difference in intraocular pressure, AC-cells, and AC-flare between the two groups up to the 28th day after surgery, but no significant difference in visual acuity between the two groups. The study's findings are consistent with those previously documented in situations involving IOL implantation and phacoemulsification. Kruger et al. discovered that individuals who received heparin-supplemented irrigating fluid had a reduced inflammatory cellular response in the anterior chamber.[14] In a study conducted by Kruger et al. and Kohnen et al., the anti-inflammatory effect of heparin lasted until the first and third postoperative days, respectively.[14,15] The number of participants in our study was lower than in prior studies, which is one of the two main differences between the two. Therefore, additional studies and trials with a bigger sample size are required to further support the findings.

In contrast to our study, these investigations measured the cells and flare in the anterior chamber using a laser flare and cell photometer.

According to research, heparin sodium is a workable way to prevent inflammation by inhibiting the complement pathways, inhibiting the formation of several complement factors, interfering with terminal cell lysis.[16] In addition, heparin can interact with pro-inflammatory cytokines and chemokines,[17] preventing these pro-inflammatory molecules from interacting with their specific receptors. Some evidence shows that heparin interferes with the adhesion of leukocytes to the endothelium.[17] The group 1 improved significantly after a day compared to the group 2 because of the inflammatory process and AC cellular activity were under control. Within 24 hours, all cases in group1(with heparin sodium) showed a considerable improvement in vision without any complications or irritation. By lowering post-operative inflammation, Heparin Sodium serves as an agent for early visual rehabilitation in addition to being appropriate for lowering cellular activity following phacoemulsification.[18]

In general, heparin is used as an anticoagulant, but it also possesses anti-inflammatory properties.[19] By suppressing fibroblastic activity, it prevents fibrous responses during intraocular surgery.[20] Because of these special qualities, researchers are using heparin in surface-modified IOLs for cataract surgery.[20,21] In a similar view, Bayramlar and associates came to the conclusion that heparin added to the irrigating solution during surgery

reduces late inflammatory problems and postoperative fibrinous response. In their study, Ihsan Ç and colleagues came at the same conclusion. [22]

Follow-up for longer period wasn't a part of this study, therefore, long-term impact on complications like cystoid macular edema (CME) and posterior capsular opacification (PCO) in adult cataract patients could not be assessed as they are not the main objectives of study. Further small size did not allow us to do adjustments for multiple comparisons, as a smaller sample may give a result that may not be sufficiently powered to detect a difference between the groups and the study may turn out to be falsely negative leading to a type II error. Nevertheless, our study has shed light on the potential significance of heparin in reducing the post-operative inflammation, which can inspire our colleagues to create additional studies to address the shortcomings of our study.

Conclusion:

In the phacoemulsification process, heparin sodium was added to the infusion bottle as an anti-inflammatory. The study concluded that using heparin sodium as an anti-inflammatory drug could be effective in lowering post-operative inflammation and reaction.

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