Comparing Peribulbar and Topical Anaesthesia in Cataract Surgery among Patients with Cardiovascular Disease

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ABSTRACT

Purpose – To compare topical and peribulbar anaesthesia in cataract surgery for hemodynamic changes, rate of complications and pain score in patients with cardiovascular disease.

Material and Methods - A prospective comparative study at a tertiary care centre in India. Patients ≥ 40 years old with treated/controlled hypertension and cardiovascular disease scheduled for cataract surgery under topical or peribulbar anaesthesia were recruited. Heart rate, blood pressure (BP), and ophthalmic and systemic complications were noted: preoperatively, immediately after block, intra-operatively, immediately postoperatively and one hour postoperatively. A Visual Analogue Scale (VAS) was used to assess the pain score.

Results – A total of 150 patients (75 in each group) underwent cataract surgery. There was a significant rise in pulse rate and BP after peribulbar injection and intra-operatively, which gradually reduced to baseline one hour after surgery in both groups (P < 0.001), with systolic blood pressure (SBP) intra-operatively being significantly greater in the peribulbar group (peribulbar: 155.49 ±18.14mmHg, topical:147.95 ±17.71mmHg; P = 0.01). The topical group (1.12 ± 0.99) had slightly lower VAS scores than the peribulbar (1.44 ± 0.90), P = 0.04.

Conclusions - Cataract surgery appears safe in patients with adequately controlled cardiovascular disease, and topical anaesthesia may be preferable due to non-invasiveness, adequate analgesia, and minimal effect on haemodynamic parameters. Therefore, hemodynamically stable patients of cardiovascular disease undergoing uncomplicated cataract surgery may be counselled for topical anaesthesia.

Keywords: Cataract surgery; topical anaesthesia; peribulbar anaesthesia; cardiovascular disease; haemodynamics
INTRODUCTION

Cataract is the leading cause of blindness in the world, being particularly common in low-income countries. Since most of these patients are elderly, they often suffer from concomitant cardiovascular disease. Systemic hypertension affects one billion individuals worldwide and is endemic in the elderly population. [1, 2] Previous studies have shown an increased incidence of hemodynamic instability, myocardial ischaemia, and cardiac arrhythmias in patients with severe hypertension [systolic blood pressure (SBP) >180, diastolic blood pressure (DBP) >110]. Still, there is little evidence of perioperative complications with blood pressure (BP) <180/110. [3]

Patients undergoing cataract surgery are susceptible to ischaemic heart disease due to risk factors like hypertension, old age, atherosclerosis, and diabetes. [4] While topical anaesthesia is the current norm for cataract surgery, patients who cannot cooperate with it require regional anaesthesia. This includes patients with multiple systemic co-morbidities, particularly cardiovascular disease, which increase in prevalence with age. Regional anaesthesia most commonly used for cataract extraction carries a low to moderate risk of haemodynamic instability in these patients. [5] We aimed to compare peribulbar injection with topical anaesthesia for pre-injection/post-injection (peribulbar group), preoperative (topical anaesthesia), intra-operative and postoperative changes in hemodynamic parameters/complications and pain score in a tertiary care hospital in India.

SUBJECTS AND METHODS

This hospital-based prospective comparative clinical study was conducted at a tertiary care hospital in South India and followed the tenets of the Declaration of Helsinki after approval of the Institutional Ethics Committee. The study was conducted on 150 patients ≥ 40 years of age, scheduled for cataract surgery (phacoemulsification/MSICS) with concomitant controlled cardiovascular disease receiving treatment from Internal Medicine/Cardiology after physician approval and informed consent. Antiplatelet medications were discontinued for five days before surgery in patients who were taking them. Exclusion criteria were: patients allergic to lignocaine 2%, bupivacaine 0.5% or proparacaine 0.5%, patients with severe hypertension (SBP>180 mm Hg, DBP>110 mm Hg), hemodynamically unstable patients and patients with complicated cataract, traumatic cataract, uveitic cataract, pseudo-exfoliation, and lens-induced glaucoma.

Patients were recruited into two groups (peribulbar injection or topical) based on their willingness for topical anaesthesia, each group comprising 75 patients. Group A: topical proparacaine 0.5% with or without lignocaine 2% gel. Group B: peribulbar bupivacaine 0.5%, lignocaine 2% and hyalase. Patients in Group A received four
doses (approximately 40µl per dose) of unpreserved proparacaine 0.5% drops that were instilled on the ocular surface (two doses on the cornea, and one each in the superior and inferior conjunctival cul de sac) ten minutes before surgery. Five minutes before surgery, two further doses were instilled in the cornea. If necessary, lignocaine 2% gel was also used. Patients in Group B received a 5ml mixture of lignocaine 2%, bupivacaine 0.5% and hyaluronidase that was injected into the peribulbar area at the junction of the outer one third and inner two-thirds of the inferior orbital rim ten minutes before surgery with a one-inch 26-gauge needle, with an additional 2-4ml injected at the junction of inner one third and outer two-third of the superior orbital rim, if necessary.

All patients received monitored anaesthesia care throughout the surgery. In the topical anaesthesia group, pulse rate and BP were recorded preoperatively in the waiting area, intra-operatively, immediately after surgery and one hour after surgery in the ward. In the peribulbar group, pulse rate and BP were recorded before giving a peribulbar anaesthetic injection in the waiting area, after the injection, intra-operatively, immediately and 1 hour after surgery. Pre-operative and post-operative electrocardiograms (ECG) were taken. None of the patients required sedation. Any intraoperative complications during the surgery were recorded. Patients were given a postoperative questionnaire to assess their comfort levels during surgery. Total surgical time was noted from the start of the incision to the closure of the wound. For the pain score, a visual analogue scale (VAS) questionnaire (on a scale of 0-10, with 0 indicating no pain and ten indicating unbearable pain) was administered to the patient one hour after the surgery for overall pain scoring.

**Sample size calculation:**

A power analysis using the G power computer program indicated that a total sample of 140 would be needed (70 in each group) to detect medium effects (d=0.30) with 90% power using a t-test between means with alpha at 0.05. [6]

**Statistical analysis:**

The collected data were analysed using descriptive and inferential statistics. The independent samples t-test was used to evaluate the statistical significance of change between the two groups of each measured variable. Repeated measures analysis of variance (RM-ANOVA) was used to test the significant difference in changes over time within the group. Chi-square was used for measuring the differences between categorical variables. A $P$ value of less than 0.05 was considered statistically significant. All statistical analysis was done using statistical software, SPSS version 19.
RESULTS

The study was conducted on 150 patients aged 40 years and above with underlying cardiovascular disease requiring cataract surgery. Patients undergoing cataract surgery under topical anaesthesia were significantly younger than those under peribulbar anaesthesia (Peribulbar: 64.83±8.15 years, Topical: 58.91±8.17 years, \( P < 0.001 \)). Patients in both groups had a comparable number of co-morbidities (\( P = 0.352 \)). In the peribulbar group, a greater number of patients were suffering from coronary artery disease (CAD) as compared to the topical anaesthesia group (ten versus four). (Table 1) In the peribulbar group, 65 patients had immature senile cataracts (IMSC) and ten presented with mature senile cataracts (MSC), whereas these numbers were 74 and one for the topical anaesthesia group. (\( P = 0.004 \)) All patients underwent uneventful phacoemulsification with posterior chamber intraocular lens implantation, with full visual recovery.

There was a significant rise in pulse rate and BP after peribulbar injection and intra-operatively, which gradually reduced to baseline one hour after surgery in both groups (\( P < 0.001 \)), with SBP intra-operatively being significantly higher in the peribulbar group (peribulbar: 155.49±18.14mmHg, topical:147.95±17.71mmHg; \( P = 0.01 \)). (Figure 1) The quantum of change was maximum following the peribulbar injection, especially in the SBP. (Table 2) We did not find any new ECG changes before, during or after surgery in any patient.

Total surgical time was comparable between both groups (topical: 11.80±1.50 min, peribulbar: 11.87±1.70 min; \( P = 0.80 \)). No systemic and ophthalmic complications were noted in any patient. There was a significant difference in VAS scores between the topical (1.12±0.99) and peribulbar patients (1.44±0.90), (\( P = 0.04 \)), indicating greater patient satisfaction with topical than peribulbar anaesthesia. There was no statistically significant difference between the two groups for reported discomfort.

DISCUSSION

This prospective comparative clinical study shows the effect of topical and peribulbar anaesthesia on hemodynamic and ECG changes. In addition, complication rates (systemic and ophthalmic), patient discomfort and total surgical time were also noted. In our study, patients undergoing cataract surgery under topical anaesthesia (58.91±8.17 years) were significantly younger than those under the peribulbar block (64.83±8.15 years). Younger patients who are more alert and cooperative likely chose topical anaesthesia.
We found the rise in pulse rate greatest after peribulbar injection with a gradual return to baseline in the postoperative period, with no significant difference between the two groups, similar to earlier reports. [5, 7] We also observed a significant difference in intra-operative SBP changes, higher in the peribulbar group. The SBP peaked after peribulbar injection, but no adverse events were noted. The DBP was not significantly different between the two groups, though a slight increase was seen after peribulbar injection. Glantz et al. reported a few minutes of transient hypertension when the block was performed. [4] A significantly higher SBP after regional anaesthesia compared with topical and sub-tenon injection was also noted by Ryu et al. [7] Yap et al. found a significant rise in SBP intra-operatively, in the pre-assessment and anaesthetic room. [8] Fichmann et al. reported that only one percent of patients had raised BP when topical anaesthesia alone was used in cataract surgery. [9] Hence, it appears that topical anaesthesia has a lower propensity to affect hemodynamic changes due to its non-invasiveness.

Agarwal et al. reported a significant increase in hypertensives who developed isolated systolic hypertension in the holding area while studying the effect of perioperative blood pressure on intraoperative complications during phacoemulsification surgery under local anaesthesia. [10] Basta et al. prospectively studied systemic adverse events during phacoemulsification under monitored anaesthesia care and observed that arterial hypertension and agitation were the most frequent. [11] We, too, noted a sudden rise in BP in a few patients in the holding area, and deferred surgery for these patients (as per standard hospital protocol), pending further physician evaluation. Only those patients whose cardiovascular status was subsequently controlled to meet our criteria were operated upon later and included in the study. This extra care may be one of the reasons for zero cardiovascular adverse events in our study, similar to previous reports. [12,13] All participants were receiving appropriate therapy for all other disorders as well.

The total surgical time was similar between the two groups. Expert surgeons performed all the surgeries, and we did not observe any complications during cataract surgery. We observed that patients who underwent cataract surgery under topical anaesthesia perceived slightly less pain than patients who underwent cataract surgery under a peribulbar block. A similar finding was reported by Coelho et al. when they performed phacoemulsification without sedation using topical and peribulbar anaesthesia. [14] Zehetmayer et al. also evaluated the efficacy of topical anaesthesia as an alternative to peribulbar anaesthesia in cataract surgery. They observed that subjective pain was comparable whether topical or peribulbar anaesthesia was used. They reported good patient cooperation (motility control) in topical anaesthesia and no significant differences in complications. [15] The slightly favourable results in the topical anaesthesia group in our study may be due to the younger age of patients who
chose topical anaesthesia over a regional block. Younger, alert patients are more likely to cooperate with the surgery requirements. Comparable VAS scores prove that topical anaesthesia can effectively control pain during cataract surgery by phacoemulsification similar to a peribulbar block.

We did not randomise the patients between topical and peribulbar anaesthesia as patient co-operation and choice are the inherent requirements for topical surgery. While this is an important limitation of the current study, the findings suggest similar results between the two choices of anaesthesia management for a short procedure in stable cardiovascular patients by expert surgeons.

It is observed that owing to improvements in technology and expertise most ocular surgeries are increasingly performed topically. However, there are many situations where peribulbar anaesthesia is required, even in candidates for topical surgery. Our study emphasizes the need for rigorous monitoring of cardiovascular status preoperatively, with deferring of surgery in case of sudden-onset hypertension, to minimize the risk of adverse events. Also, in the presence of adequate preoperative cardiovascular control and consenting patients, topical anaesthesia for cataract surgery by phacoemulsification may be the optimum choice in patients with concomitant cardiovascular disease.

**Statements and declarations**

The manuscript has been read and approved by all the authors, and the requirements for authorship as stated above have been met, and each author believes the manuscript represents honest work.

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**Conflict of interest statement**

The authors declare no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

**Ethics statement**

The study was conducted after approval (number: GHIEC/2016) from the Institutional Ethics Committee of Indira Gandhi Government General Hospital and Post Graduate Institute (IGGGH&PGI), Puducherry, India, and it
adhered to the tenets of the Declaration of Helsinki.

**Consent to participate/publication**

Informed consent was obtained from the participants after an explanation of the nature and possible consequences of the study. The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their clinical information to be reported for publication. The participants understand that their identity will not be revealed.

**Data availability statement**

Data pertaining to this study will be made available upon reasonable request.
References:


Figure caption

Figure 1: Comparison of changes in systolic blood pressure from preoperative period to one-hour post-operative period in topical and peribulbar groups.
Table 1: Comparison of the demographic data between the topical and peribulbar anaesthesia groups.

<table>
<thead>
<tr>
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<th>Topical (n=75)</th>
<th>Peribulbar (n=75)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>58.91±8.17 years</td>
<td>64.83±8.15 years</td>
<td>&lt; 0.001</td>
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<tr>
<td>Gender: Men/Women</td>
<td>26/49</td>
<td>28/47</td>
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<td>Co-morbidities</td>
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<td>Hypertension</td>
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<td>75</td>
<td>0.352</td>
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<tr>
<td>Diabetes Mellitus</td>
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<td>31</td>
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<tr>
<td>Others</td>
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<td>3</td>
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Table 2: Comparison of vitals (pulse rate and blood pressure) between topical and peribulbar anesthesia groups

<table>
<thead>
<tr>
<th></th>
<th>Pre-operative</th>
<th>After injection</th>
<th>Intra-operative</th>
<th>Immediate post-operative</th>
<th>1hr post-operative</th>
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</tr>
</thead>
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<tr>
<td><strong>Pulse Rate/min</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Topical</td>
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<td>-</td>
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<td>81.77±9.78</td>
<td>81.37±10.56</td>
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<td>Peribulbar</td>
<td>83.15±12.26</td>
<td>89.28±13.44</td>
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<td>80.11±9.41</td>
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<tr>
<td>P value</td>
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<td>-</td>
<td>0.39</td>
<td>0.90</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td><strong>SBP</strong> (mmHg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topical</td>
<td>148.47±18.67</td>
<td>-</td>
<td>147.95±17.71</td>
<td>145.20±19.42</td>
<td>143.61±19.53</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Peribulbar</td>
<td>148.59±17.68</td>
<td>161.52±19.11</td>
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<tr>
<td>P value</td>
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<td>-</td>
<td><strong>0.01</strong></td>
<td>0.53</td>
<td>0.81</td>
<td></td>
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<tr>
<td><strong>DBP</strong> (mmHg)</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Topical</td>
<td>84.88±9.29</td>
<td>-</td>
<td>85.97±9.63</td>
<td>84.72±9.81</td>
<td>82.91±9.54</td>
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<tr>
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<td>-</td>
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<td>0.73</td>
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<td></td>
</tr>
</tbody>
</table>

*SD: standard deviation, †SBP: systolic blood pressure, ‡DBP: diastolic blood pressure, §ECG: electrocardiogram