Comparison of the Efficacy of Subtenon with Peribulbar Local Anesthesia without Hyaluronidase in Patients Undergoing Cataract Surgery

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ABSTRACT

Objective: To compare the efficacy of subtenon with peribulbar local anesthesia without hyaluronidase in patients undergoing cataract surgery.

Study Design: A randomized controlled trial.

Place and Duration of Study: Eye “B” Unit, Khyber Teaching Hospital, Peshawar, from October 2009 to October 2010.

Methodology: Patients undergoing cataract surgery were divided into two groups. Group A received subtenon anesthesia and group B received peribulbar anesthesia. Pain score, akinesia and intraocular pressure were compared in the two groups. Statistical Package for Social Sciences-14.0 was used for data analysis.

Results: There were 304 patients, 152 patients in each group. At the time of injection, there was less pain in group A as compared to group B (p < 0.001). At the time of surgery and till 90 minutes after administration of anesthesia, there was no significant difference in pain between the 2 groups (p = 0.999 and 0.59 respectively). Group A had better akinesia as compared to group B (p = 0.04). There was a greater rise in mean intraocular pressure just after injection in group B as compared to group A (p < 0.001); in both groups, the intraocular pressure declined to its base level 10 minutes after the injection (p = 0.52).

Conclusion: Subtenon anesthesia is less painful at the time of its administration, provides better akinesia and leads to smaller rise in intraocular pressure just after the injection than peribulbar anesthesia.

Key Words: Analgesia. Peribulbar anesthesia. Subtenon anesthesia.

INTRODUCTION

Cataract surgery is the most commonly performed intraocular surgery. Cataract surgery can be carried out under general or local anesthesia. Due to unwanted effects of general anesthesia,¹ local anesthesia is preferred by most surgeons and patients for cataract surgery; the latter having good analgesia and quick recovery.²

Local anesthesia includes topical anesthesia and regional anesthesia. Topical anesthesia affects only the nerve endings of the trigeminal nerve in the cornea and conjunctiva so akinesia of the globe will not be achieved, therefore, good patient cooperation is required for safe use of topical anesthesia.³ One type of regional anesthesia is peribulbar which is performed by injecting the anesthetic solution in the orbit around the equator of the eyeball using sharp needle and another is subtenon which involves the use of blunt canula.⁴ Serious complications such as sight threatening like globe perforation and life threatening like brainstem depression have a 2.5-fold greater risk in sharp needle techniques (peribulbar, retrobulbar) as compared with subtenon block.⁵ While subtenon block has 2.3-time greater risk of minor complications like subconjunctival hemorrhage and conjunctival chemosis.⁵

The goal of ideal local anesthesia is to obtain complete akinesia of the eyeball and low intraocular pressure (IOP) in order to provide optimal surgical conditions.⁶ Intraocular pressure increases significantly in many eyes after peribulbar anesthesia⁷ while there is minimal rise in IOP after subtenon anesthesia.⁸ Both of these blocks provide excellent and equal analgesia.⁹ There are controversies²,¹⁰ regarding comparison of akinesia after the subtenon and peribulbar blocks. Hyaluronidase permits a 2.4-fold reduction in the median effective local anesthetic volume (MLAV) for subtenon anesthesia.¹¹ The addition of hyaluronidase hydrolyses part of the intracellular matrix that maintains tissue integrity allows the anesthetic agent to disperse more extensively around the orbit and may allow smaller volumes to be given. Most of the studies done on the efficacy of subtenon anesthesia had added hyaluronidase to the
local anesthetic solution. However, hyaluronidase is not available in Pakistan and we have done this study using injection lignocaine with adrenaline but without hyaluronidase as the anesthetic solution.

The objective of this study was to compare the efficacy of subtenon with peribulbar local anesthesia without hyaluronidase in patients undergoing cataract surgery. This will help to find the safe, acceptable and effective technique of local anesthesia for cataract surgery.

**METHODOLOGY**

This study was carried out at the Eye B Unit, Khyber Teaching Hospital (KTH), Peshawar, from 1st October 2009 to 1st October 2010. It was a randomized controlled trial. Before starting the study, approval was taken from the institutional ethical review board and written informed consent was taken from all patients.

Patients admitted for cataract surgery who were in the age group between 50 - 70 years were included in the study. Patients having uncontrolled diabetes or hypertension, glaucoma or ocular hypertension, hypersensitivity to lignocaine and patients who were not cooperative and were not suitable for regional anesthesia like mentally retarded and those having history of convulsions or epilepsy were excluded from the study.

Patients who underwent uneventful phacoemulsification with foldable intraocular lens implantation at Eye B Unit, KTH, Peshawar by the same surgeon, during the study period, were included in the study. The cases were randomly divided into two groups as group A and group B. Patients in group A received subtenon anesthesia and patients in group B received peribulbar anesthesia. Lignocaine 2% with 1:200000 adrenaline but without hyaluronidase was used as the anesthetic solution. Before subtenon injection, topical anesthetic drops (Proparacaine 0.5%) were instilled in the eye, wire speculum was inserted, and the patient was asked to look upward and temporarily. The conjunctiva along with tenon's capsule in the lower nasal quadrant was slightly elevated from the sclera with conjunctival forcep and a single cut was made with conjunctival scissors under operating microscope. Four ml of anesthetic solution (taken in a 5 ml syringe connected to a blunt subtenon anesthesia cannula) was injected into the subtenon space beyond the equator. For peribulbar anesthesia, double sites injection was given using a 5 ml disposable syringe connected to a 23 gauge needle. Three ml of anesthetic agent was injected inferotemporally through the lower lid just above the inferior orbital rim at the junction of its lateral third and medial two thirds. Another injection (1.5 ml solution) was given superiorly at the junction of medial one third and lateral two third i.e. at a point just inferior to the supraorbital notch. After both techniques, gauze bandage was applied to eye over closed lids and pressure given for 10 minutes with 2 minutes interval release of pressure pad.

Efficacy of procedure was defined in terms of pain experienced by the patients (using 0 - 10 numeric rating scale for pain) at the time of administration of anesthesia, during surgery and till 90 minutes after administration of anesthesia. Akinesia was determined by measuring ocular movements in all four directions (superior, inferior, medial and lateral) using caliper 10 minutes after administration of anesthesia according to the following score system; no movement of the globe=0, < 2 mm movement=1 and > 2 mm movement=2. Intraocular pressure (IOP) was measured with Perkins tonometer MK2 (Clement Clarke London) just before one minute after and 10 minutes after the anesthesia administration.

Statistical Package for Social Sciences (SPSS) version 14.0 was used for data analysis. Descriptive statistics like mean and standard deviation were calculated for age and intraocular pressure while frequencies and percentages were calculated for gender, pain and akinesia. P-value was generated using student t-test for comparison of intraocular pressure and chi-square test for comparison of pain and akinesia of both types of anesthesia procedures. P-value < 0.05 was considered significant.

**RESULTS**

The number of patients in this study was 304 i.e. 152 patients in each group. Mean age of patients in group A was 59.74 ± 5.58 years and in group B it was 59.88 ± 5.91 years (p=0.83). In group A, there were 79 (51.97%) females and 73 (48.02 %) males and in group B, there were 77 (50.65%) female and 75 (49.34%) male (p=0.73).

At the time of its administration, subtenon anesthesia was less painful than peribulbar anesthesia as shown in Table I (p < 0.001). At the time of surgery and till 90 minutes after administration of anesthesia, there was no significant difference in pain between the two groups, as shown in Table I (p=0.999 and 0.59 respectively).

Setting the target score of 4 mm or less for akinesia and more than 4 mm for no akinesia we found that in group A, 102 (67.10%) patients had akinesia while 50 (32.89%) had no akinesia; in group B, akinesia was present in 84 (55.26%) patients and 68 (44.73%) patients had no akinesia as shown in Figure I (p=0.04).

There was no significant difference in mean IOP in the two groups just before the administration of anesthesia (p=0.72). One minute after anesthesia it increased to 14.99 ± 1.25 mmHg in group A and 17.37 ± 1.28 mmHg in group B (p < 0.001). At 10 minutes after administration of anesthesia, IOP declined in both groups (p=0.52), as shown in Table II.
There are different techniques of local anesthesia available for cataract surgery. Topical anesthesia is free of serious and life threatening complications and can be used in selected cases, however, it lacks akinesia and a possible association between topical anesthesia and endophthalmitis has been established. Patients undergoing cataract surgery under topical anesthesia experience more postoperative discomfort as compared to subtenon anesthesia. Needle blocks like peribulbar and retrobulbar anesthesia provide excellent analgesia and akinesia, however, serious and life threatening complications can occur with them. Therefore, these techniques require intravenous lines and presence of anesthetist and should be performed under the supervision of senior and experienced ophthalmic surgeons. Subtenon technique is safe, effective and painless and is a perfect block. There is a statistically significant increased risk of serious complications with sharp needle anesthesia as compared to subtenon technique.

An ideal anesthetic technique must be safe from serious complications, effective in terms of providing good akinesia, analgesia and must not elevate intraocular pressure in order to provide optimal surgical conditions. The purpose of this study was to compare the efficacy of subtenon with peribulbar anesthesia in terms of analgesia at the time of administration of anesthesia, during surgery and till 90 minutes after administration of anesthesia, akinesia 10 minutes after anesthesia administration and rise in intraocular pressure after anesthesia administration.

Pain was assessed using 0 - 10 rating score and was categorized into no pain, mild pain, moderate pain and severe pain. ‘No pain’ and ‘mild pain’ interfered from very little to none in the procedure, both the patient and surgeon were comfortable and patient did not complain. ‘Moderate pain’ interfered significantly and patient complained to the surgeon about the pain and both the surgeon and patients were not comfortable with that pain. There was a significant difference between the two groups i.e. subtenon anesthesia was less painful than peribulbar anesthesia at the time of administration. Similar results were seen in other studies as well. Pain during surgery and till 90 minutes after administration of anesthesia was identical in both groups which is comparable with other studies.

Comparing the akinesia 10 minutes after anesthesia administration in both groups, we found that there was significant difference between the two groups i.e. patients in group A had better akinesia as compared to group B. Similar results were shown in other studies as well. In the present study, all patients in both groups received anesthesia from only one experienced surgeon, each surgery started 10 minutes after anesthesia administration with digital compression for these 10 minutes. In this study, proper method of measuring ocular movement in all directions, using caliper, was adopted.

### Table I: Comparison of pain between the two groups.

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>At the time of administration of anesthesia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No pain</td>
<td>72 (47.36%)</td>
<td>00</td>
</tr>
<tr>
<td>Mild pain</td>
<td>80 (52.63%)</td>
<td>88 (57.89%)</td>
</tr>
<tr>
<td>Moderate pain</td>
<td>00</td>
<td>64 (42.10%)</td>
</tr>
<tr>
<td>Severe pain</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td>p-value</td>
<td>&lt; 0.001</td>
<td></td>
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</tbody>
</table>

### Table II: Comparison of mean intraocular pressure between the two groups.

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOP just before anesthesia</td>
<td>12.16 ± 1.23</td>
<td>12.11 ± 1.22</td>
<td>0.72</td>
</tr>
<tr>
<td>IOP 1 minute after anesthesia</td>
<td>14.99 ± 1.25</td>
<td>17.37 ± 1.28</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>IOP 10 minutes after anesthesia</td>
<td>11.97 ± 1.22</td>
<td>11.88 ± 1.25</td>
<td>0.52</td>
</tr>
</tbody>
</table>

**DISCUSSION**

There are different techniques of local anesthesia available for cataract surgery. Topical anesthesia is free of serious and life threatening complications and can be used in selected cases. However, it lacks akinesia and a possible association between topical anesthesia and endophthalmitis has been established. Patients undergoing cataract surgery under topical anesthesia experience more postoperative discomfort as compared to subtenon anesthesia. Needle blocks like peribulbar and retrobulbar anesthesia provide excellent analgesia and akinesia, however, serious and life threatening complications can occur with them. Therefore, these techniques require intravenous lines and presence of anesthetist and should be performed under the supervision of senior and experienced ophthalmic surgeons. Subtenon technique is safe, effective and painless and is a perfect block. There is a statistically significant increased risk of serious complications with sharp needle anesthesia as compared to subtenon technique.

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Comparing the akinesia 10 minutes after anesthesia administration in both groups, we found that there was significant difference between the two groups i.e. patients in group A had better akinesia as compared to group B. Similar results were shown in other studies as well. Some studies showed equal akinesia for both groups but in these studies sample size was smaller than in this study. One study showed that there was no absolute akinesia in subtenon group as compared to 64.8% in peribulbar group. But in that study surgeries were performed by four different surgeons, surgery started just after administration of anesthesia in subtenon group and each surgeon was asked to score akinesia after surgery. In the present study, all patients in both groups received anesthesia from only one experienced surgeon, each surgery started 10 minutes after anesthesia administration in both groups with digital compression for these 10 minutes. In this study, proper method of measuring ocular movement in all directions, using caliper, was adopted.
Intraocular pressure measured just before and 1 minute after administration of anesthesia revealed that there was a greater rise in mean IOP in group B as compared to group A. This difference between the two groups was highly significant statistically and was comparable with the results of other studies.10,22 Mean IOP declined to the base level 10 minutes after anesthesia administration in both groups. Thus, 10 minutes after anesthesia administration, there was no significant difference in the IOP between the two groups, which is comparable with other studies.10,22 Therefore, both groups had equally optimal surgical conditions.

At the study place, tablet acetazolamide 500 mg is given to all patients undergoing cataract surgery, at least 1 hour before surgery. This keeps the intraocular pressure at a lower level than the patient’s actual intraocular pressure. If the patients are not given oral acetazolamide before surgery, there may be a greater intraocular pressure elevation just after administration of anesthesia. With peribulbar anesthesia, the intraocular pressure may be elevated to the level, although for a short time, sufficient to cause reduction in pulsatile ocular blood flow which may cause potential problems for patients with ocular vascular compromise.23

CONCLUSION
Subtenon anesthesia was less painful than peribulbar anesthesia at the time of administration of anesthesia, although, during surgery and till 90 minutes after administration, there is no difference in pain between the two groups. Subtenon anesthesia provides better akinesia than peribulbar anesthesia. Subtenon anesthesia leads to smaller rise in IOP than peribulbar anesthesia 1 minute after the injection. However, 10 minutes after injection IOP declines to its base level in both groups.

REFERENCES