Complications of Sodium Bicarbonate Buffered Lignocaine and Hyaluronidase Mixed Lignocaine for Ocular Anaesthesia - A Comparative Study

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Abstract: Aim: To compare and evaluate the efficacy, duration of action and complications of 7.5% Sodium bicarbonate buffered lignocaine with Hyaluronidase mixed lignocaine used as Regional anaesthesia in cataract surgery. Design: A Prospective, interventional, comparative study. Participants: Three hundred cataract patients were involved in this prospective, interventional and comparative study. Methods: Two groups of patients (Group I and Group II) with 150 patients in each. The patients included in this study were examined for ocular and systemic diseases. The required pre-operative investigations for cataract surgery was done. Post-operative photographs were taken for documentation. Group I patients had 7.5% Sodium bicarbonate buffered lignocaine and group II patients had Hyaluronidase mixed lignocaine used as Regional anaesthesia. Results: Time of onset of anaesthesia and akinesia was 6-10 minutes for Group I and 5 minutes for Group II patients. More number of patients in Group I had Intra operative complications like Repeat block, Conjunctival Chemosis, Persistant eye movements (akinesia not achieved) and also Post-operative complications like Posis and Lid edema than in Group II. Analgesia was better in Group I than in Group II. Conclusion: All Complications like chemosis, lid edema and posis was more in sodium bicarbonate buffered lignocaine group resolved totally with maximum period being 4 days and one Ptosis resolved in 2 weeks. None of them had visual or systemic side effects. The advantage in using Sodium Bicarbonate buffered Lignocaine was cost effective and safely available.

Keywords: Akinesia, Analgesia, Chemosis, Hyaluronidase, 7.5% Sodium bicarbonate buffered lignocaine

1. Introduction

A comparative, interventional and prospective study using 7.5% sodium bicarbonate and hyaluronidase for regional anesthesia by Peribulbar block in patients for cataract surgery.

Hyaluronidase a highly purified bovine testicular enzyme that hydrolyzes extracellular hyaluronic acid, is a desirable component for promotion of spread within the orbit and for hypotony \(^{1,15}\). Hyaluronidase is costly and availability is limited \(^{16}\). The addition of hyaluronidase promotes spread of local anaesthesia and prolongs orbital akinesia as described by Hamilton and colleagues \(^{2}\).

Sodium bicarbonate is an alternative drug, by which the time of onset and spread of neural blockade can be enhanced significantly \(^{2}\). Alkalisation (carbonation) of lignocaine hydrochloride leads to higher Ph (more than 6), which results in ‘ion – trapping’ and favours rapid movement of the local anaesthetic in to the axon as in Galindo et al study. Sodium bicarbonate is cost effective and easily available \(^{2}\).

This prospective study was done to assess complications of 7.5% Sodium bicarbonate buffered lignocaine and Hyaluronidase mixed lignocaine.

2. Materials and Methods

Study Population - 300 Patients.
Study Period - 6 Months, December 2015 – May 2016.
Study Place - Department of Ophthalmology, Government Mohan Kumaramangalam, Medical College Hospital, Salem.
Study Type - Prospective, interventional and Comparative study.
Study Tool - Intra operative and Post-Operative clinical assessment.

Anaesthetic Solution Used:
Group I: Lignocaine (30 ml) mixed with 1:200,000 dilution of epinephrine and 1 ml of Sodium Bicarbonate.

Group II: Lignocaine (30ml) with 1:200,000 dilution of epinephrine and 450 units (15U/ml) of Hyaluronidase.

Study Group
Patients undergoing cataract surgery:
Group I: 150 Patients for Regional Peribulbar ocular anaesthesia with 5 ml of 2% Lignocaine mixed with 1:200,000 of epinephrine and 1 ml of 7.5% of Sodium bicarbonate.

Group II: 150 Patients for Regional Peribulbar ocular anaesthesia with 5 ml of 2% Lignocaine mixed with 1:200,000 of epinephrine and 450 units (15U/ml) of Hyaluronidase.
Systemic and vision related complications were nil in both I had lid edema. within 5 days. Substantially more number of patients in Group II had lid edema (Fig 4 & 5) and this lid edema 16 (10.66%) patients of Group I and 6 (4%) patients of Group II. But recovery time for akinesia was 4 minutes in Group I and 3 minutes in Group II. The mean time of onset of anaesthesia and akinesia was less than 5 minutes in 74.7% of patients in Group I and 82.7% in Group II as compared to 51.5% in Srinivasan et al study. The time of onset of anaesthesia did not exceed 8 minutes in both group I & II. The mean time of onset of anaesthesia and akinesia was 4 minutes in Group I and 3 minutes in Group II. The duration of anaesthesia in both groups I & II was 20 minutes.

Scrutinizing the complications, Reblock given for 7 (4.6%) patients in Group I and for 3 (2%) patients in Group II. 12 (8%) patients of Group I and 4 (2.6%) patients of Group II had chemosis. (Fig 3). Chemosis was comparatively more in Group I patients. Akinesis was not achieved for 5 (3.33%) patients in group I and 2 (1.33%) patients in Group II. Analgesia was not achieved in 4 (2.66%) patients of Group I and in 8 patients (5.33%) of Group II. Analgesia was better in Group I patients than in Group II patients (Table I).

Contemplating the Post-operative complications, Ptosis was present in 12 patients (4%) Group I and in 2 patients (0.66%) in Group II. All patients completely recovered from ptosis. But recovery time for one patient in Group I was longer with the maximum period being 2 weeks (Fig 1 & 2).

16 (10.66%) patients of Group I and 6 (4%) patients of Group II had lid edema (Fig 4 & 5) and this lid edema resolved within 5 days. Substantially more number of patients in Group I had lid edema.

Systemic and vision related complications were nil in both Groups.

3. Results

300 patients in the age group 16 - 70 yrs requiring cataract surgery were included in the study after obtaining informed consent. The study had 150 patients each in Group I and Group II.

The anaesthesia and akinesia was achieved within 5 min in 112 (74.7%) patients of Group I and 124 (82.7%) patients of Group II. The onset of anaesthesia and akinesia was less than 5 minutes in 74.7% of patients in Group I and 82.7% in Group II as compared to 51.5% in Srinivasan et al study. The time of onset of anaesthesia did not exceed 8 minutes in both group I & II. The mean time of onset of anaesthesia and akinesia was 4 minutes in Group I and 3 minutes in Group II. The duration of anaesthesia in both groups I & II was 20 minutes.

4. Discussion

During shipping and storage, Local anaesthetic agents are usually transported as acidic salts to avoid precipitate (5,6). Alkalinisation with sodium bicarbonate solution increases the non-cation form of drug as alkalinisation of local anesthetics is an active form of drug (5,6). Hyaluronidase breaks down C1-C4 bonds between glucosamine and glucuronic acid in connective tissue, which enables the local anesthesia to permeate the tissues more effectively (11).

Among 150 patients in Group I who were anaesthetized with sodium bicarbonate buffered lignocaine Peribulbar anaesthesia, 112 (74.7%) developed anaesthesia and akinesia within 5 minutes being closely equal to 82.7% of Group II who were anaesthetized with hyaluronidase mixed lignocaine.

Reblock was given to 7 (4.6%) patients of group I, as anaesthesia was inadequate. Among these, five (3.3%) were in the age group of 30-45 years. Young adults present more of a challenge in achieving anaesthesia than elderly because of the denser connective tissue hindering the access of anaesthesia to the motor nerves to extra ocular muscles (3) of Group II were reblocked as compared to akinesia reported in the age group of 40-50 years in Albert study (7) and 10% of reblock rate in Miller study (8) as compared to 3.3% in our study.

2.6% in Group I and 4% in Group II had pain intra operatively. Less number of patients in Group I had pain during surgery which was due to the advantage of alkalinisation of Lignocaine. Higher PH of the solution results in less stunning pain (9) and rapid onset of action of alkalinized local anesthetic also reduced pain (10). Eccarius et al reported significant reduction in pain when buffered injections were used compared to unbuffered injection for Peribulbar anaesthesia also proved in this study.

Post-operative Ptosis is a complication that can be seen after ophthalmic surgery due to edema of upper eyelid and orbital compression (12). Lid edema reported in this study was more in Group I than in Group II. This is due to greater diffusion of alkalinized anaesthesia in to the tissues (13) and this completely resolved in 4 days. None of the patients in this study had diplopia, so not only hyaluronidase, sodium bicarbonate also helped in preventing damage to extra ocular muscles especially the inferior rectus muscle preventing diplopia (11).

No untoward Systemic illness or visual loss was reported in both the groups. Anaphylaxis and Pseudo tumor reaction which were reported in Hyaluronidase mixed Peribulbar anaesthesia in some studies were also not reported in this study (9).

Hyaluronidase and Sodium bicarbonate are equally good in absorption as they are used as an adjuvant to increase the absorption and dispersion of injected drugs (14). Absorption is reduced in patients with circulatory failure in whom tissue perfusion is reduced (9).
5. Conclusion

In summation, the side effects due to Sodium Bicarbonate buffered lignocaine in Group I was 18.66% which is higher in comparison to Group II of 5.33%. All complications due to regional anaesthesia with sodium bicarbonate buffered lignocaine resolved within a period of 4 days with one case of Posis recovered in 14 days. None of them had visual or systemic complications. Advantages being quick onset of anaesthesia and good analgesia when compared to hyaluronidase mixed lignocaine. Also it is very cost effective and readily available. Based on this study Sodium bicarbonate buffered lignocaine was found to be a good alternative for Hyaluronidase mixed lignocaine in regional anaesthesia.

References


Author Profile


R Thenmozhi received M.B.B.S in Government Mohan Kumaramangalam Medical College, Salem in 1997 and M.S (ophthalmology) in Regional Institute Of Ophthalmology and Government Ophthalmic Hospital, Chennai in 2009 respectively. Now working as Senior Assistant Professor in Government Mohan Kumaramangalam medical college, Salem.

Figures and Tables

Table 1: Comparison Between Group I & Group II in Anaesthesia, Akinesia and its duration:

<table>
<thead>
<tr>
<th>S No</th>
<th>Characters</th>
<th>Group I (Sodium Bicarbonate Buffered Lignocaine)</th>
<th>Group II (Hyaluronidase Mixed Lignocaine)</th>
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<td>1</td>
<td>Total Cases</td>
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<tr>
<td>2</td>
<td>Type of Anaesthesia</td>
<td>Peri Bulbar</td>
<td>Peri Bulbar</td>
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<td>3</td>
<td>Time Of Onset Of Anaesthesia &amp; Akinesia</td>
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<tr>
<td></td>
<td>&lt;5 Minutes</td>
<td>112 (74.7%)</td>
<td>124 (82.7%)</td>
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<tr>
<td></td>
<td>5-10 Minutes</td>
<td>38 (25.3%)</td>
<td>26 (17.3%)</td>
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<td></td>
<td>10-15 Minutes</td>
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<tr>
<td>4</td>
<td>Reblock Rate</td>
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<td>3 (2%)</td>
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<tr>
<td>5</td>
<td>Mean Time Of Onset of Anaesthesia and Akinesia</td>
<td>4 MINUTES</td>
<td>3 MINUTES</td>
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<tr>
<td>6</td>
<td>Duration of Anaesthesia</td>
<td>20 MINUTES</td>
<td>20 MINUTES</td>
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</table>
Chart 1: Comparison Between Intraoperative Complications of Group I and Group II

- **Repeat Block**
- **Chemosis**
- **Analgiesia**
- **Persistent Extraocular movements**

**Figure 1:** Right Eye- Severe Ptosis

**Figure 2:** Right Eye Moderate Ptosis

**Figure 3:** Right Eye Chemosis

**Figure 4:** Left Eye Peri Orbital Edema

**Figure 5:** Right Eye Severe Peri Orbital Edema
GROUP I
Sodium Bicarbonate Buffered Lignocaine
(Post Operative Complications)

Chart 2: Post-Operative Complications in Group I (Sodium Bicarbonate Buffered Lignocaine)

GROUP II
HYALURONIDASE MIXED LIGNOCaine
(POST OPERATIVE COMPLICATIONS)

Chart 3: Post-Operative Complications in Group II (Hyaluronidase Mixed Lignocaine)