

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

Sozhamadevi .S¹, Thenmozhi R²

¹Professor and Head of Ophthalmology, Government Mohan Kumaramangalam Medical College, Salem, The Tamilnadu Dr MGR Medical University, Tamilnadu

²Senior Assistant Professor of Ophthalmology, Government Mohan Kumaramangalam Medical College, Salem, The Tamilnadu Dr MGR Medical University, Tamilnadu

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, Persistent eye movements (akinesia not achieved) and also Post-operative complications like Ptosis 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 ptosis 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, safe and readily 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 limited¹⁶. The addition of hyaluronidase promotes spread of local anaesthesia and prolongs orbital akinesia as described by Hamilton and colleges².

Sodium bicarbonate is an alternative drug, by which the time of onset and spread of neural blockade can be enhanced significantly². Alkalinisation (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 available².

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

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Inclusion Criteria

- 1) Age – 16 – 80 years
- 2) Patients with Cataract

Exclusion Criteria

- 1) Age below 16 yrs.
- 2) Patients on drugs for any systemic illness.

Parameters Used In This Study Are:

In the Pnemonic” ABC”

A - Anaesthesia, Akinesia: time of anaesthesia given, Onset of Akinesia, duration of anaesthesia

B - Block repeat.

C - Complications-

- (1) Intra operative --- pain during surgery, extra ocular movements, increased intra ocular pressure.
- (2) Post-operative ---- Ptosis, peri orbital edema.

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 5min 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 8minutes 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. Akinesia 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.

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^(2,5). Hyaluronidase breaks down C1-C4 bonds between glucosamine and glucuronic acid in connective tissue, which enables the local anesthesia to permeate the tissues more effectively¹¹.

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 muscle³. 3 (2%) of Group II were reblocked as compared to akinesia reported in the age group of 40-50 years in Albert study³ and 10% of reblock rate in Miller study¹ 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 stinging pain¹³ and rapid onset of action of alkalinized local anaesthetic also reduced pain¹⁴. Eccarius et al reported significant reduction in pain when buffered injections were used compared to unbuffered injection for Peribulbar anaesthesia⁷ 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 compression¹². 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 tissues¹⁴ 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 diplopia¹¹.

No untoward Systemic illness or visualloss 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 study³.

Hyaluronidase and Sodium bicarbonate are equally good in absorption as they are used as an adjuvant to increase the absorption and dispersion of injected drugs⁸. Absorption is reduced in patients with circulatory failure in whom tissue perfusion is reduced⁹.

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 Ptois 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.

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Author Profile



Kumaramangalam, Medical College, Salem.

S Sozhamadevi received M.B.B.S in Madras Medical College, Chennai in 1985 and Completed M.S., D.O, Post graduation Regional Institute of Ophthalmology at Chennai in 1995. Now working as Professor and Head of Ophthalmology department, Government Mohan



Assistant Professor in Government Mohan Kumaramangalam medical College, Salem.

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

Figures and Tables

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

S No	Characters	Group I (Sodium Bicarbonate Buffered Lignocaine)	Group II (Hyaluronidase Mixed Lignocaine)
1	Total Cases	150	150
2	Type of Anaesthesia	Peri Bulbar	Peri Bulbar
3	Time Of Onset Of Anaesthesia & Akinesia		
	<5 Minutes	112 (74.7%)	124 (82.7%)
	5-10 Minutes	38 (25.3%)	26 (17.3%)
	10-15 Minutes	NIL	NIL
4	Reblock Rate	7 (4.6%)	3 (2%)
5	Mean Time of Onset of Anaesthesia and Akinesia	4 MINUTES	3 MINUTES
6	Duration of Anaesthesia	20 MINUTES	20 MINUTES



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



Chart 1: Comparison Between Intra Operative Complications OF GROUP I and group II

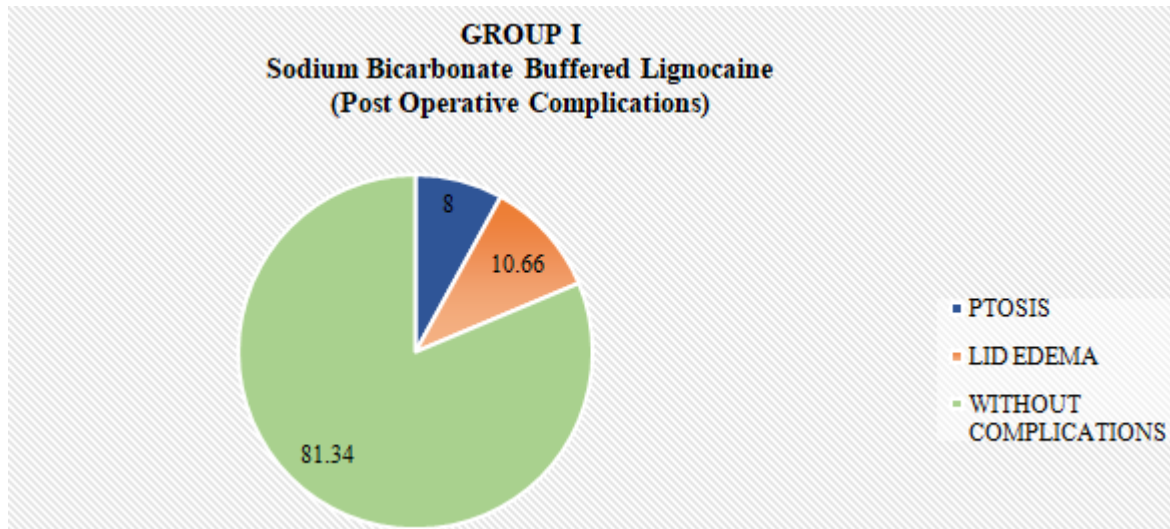


Chart 2: Post-Operative Complications in Group I (Sodium Bicarbonate Buffered Lignocaine)

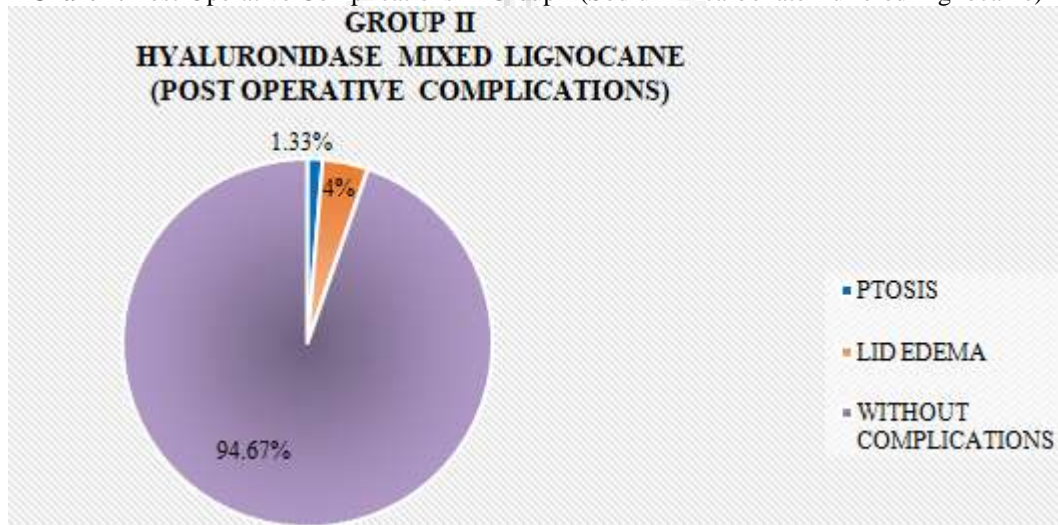


Chart 3: Post-Operative Complications in Group II (Hyaluronidase Mixed Lignocaine)