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Sodium bicarbonate buffered lignocaine verses hyaluronidase mixed lignocaine in peribulbar anesthesia: A comparative study

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ABSTRACT

Purpose: To compare sodium bicarbonate buffered lignocaine solution with hyaluronidase mixed with lignocaine in peribulbar anesthesia.

Introduction: Complete analgesia and akinesia are goals of any anesthetic procedure used for intraocular surgery the peribulbar technique is popular for safer approach. To achieve better efficacy of anesthesia various modifications have been made.

Hyaluronidase has been widely used in peribulbar anesthesia as it causes better absorption of anesthetic solution reducing the time of onset of anesthesia and bringing akinesia.

Recently some studies have doubted the efficiency of hyaluronidase in improving quality of anesthesia added to this cost factor of this drug, limited shelf life, and reusage in same sitting, risk of anaphylaxis due to its enzyme nature. Hence need for studying efficiency of sodium bicarbonate which is a cheaper alternative, readily in available, because of its basic nature alkalized the local anesthetic solution without risk of anaphylaxis.

Observation: The mean time for onset of total globe akinesia in group A is 4 and group B is 4.17. There was no statistical difference in two groups (p>0.05).

Conclusion: Sodium bicarbonate was shown to reduce the time of onset of block. Intraoperative analgesia is comparable in both groups, Chemosis is common complication in both groups. Sodium carbonate is cheaper alternative to hyaluronidase.

1. Introduction

Use of cocaine as a topical anaesthetic for minor surgery of conjunctiva was reported by Koller and Sigmund Freud in 1884. Dr. Herman Knapp in December 1884 published his report of retrobulbar injection of cocaine for painless enucleation of eye. The peribulbar method was described as early as 1914 by Allen, but was not popularised until 1986 in 1986, Devis and Mendell were the first to publish on peribulbar block.[1] The goal of this method was to avoid complications arising from needle prick of retrobulbar cone, while achieving comparable effectiveness.

Various modifications of local anashetics by addition of agents like hyaluronidase and sodium bicarbonate have been practiced for a long time. Duran Reynals F in 1939 investigated a spreading factor incertain strains of streptococci, later named as "hyaluronidase" a enzyme acts primarily on hyaluronic acid.[2] Atkinson reported the advantages of using hyaluronidase in anaesthetic solution to achieve early akinesia and anesthesia.[3]Catchlove RFH concluded that in order to increase the amount of lipid soluble base needed to cross the nerve membrane, the base form of local anesthetic must be increased by adjusting the pH by addition of sodium bicarbonate.It increased the diffusing capacity of local anesthetic.[4] Galindo et al

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reported that by altering pH of local anesthetic solution with sodium bicarbonate time of onset could be reduced and spread of neural blockad enhanced significantly.[5] "Mckay et al in 1987 demonstrated increasing pH of lidocaine by adding sodium bicarbonaye decreases the pain on injection.[6] In experiments using isolated nerve preparations, alkalinisation of Iocal anesthetic solutions increases the efficacy of the blocks and affording a higher concentration of anesthetic at the nerve.[7] Gross and Ritchie observed that alkalinisation of local anesthetics decreases time of onset and increases the potency of anaesthetics.[8] Srinivasan M, et al. had evaluated efficacy, safety and cost effectiveness of sodium bicarbonate versus sodium hyaluronidase. They concluded that effectiveness in terms of onset of time,duration of block and cost, both groups are comparable to each other.[9] Zehetmayer et al. compared efficacy of sodium bicarbonate adjusted preparation of lignocaine (pH 7.2) and standard lignocaine (Ph 5.2) in clear Corneal cataract surgery. They concluded that pH adjusted lignocaine was safe effective topical anesthetic for clear corneal Surgery and had minimal local and systemic toxicity.[10] Sharma T et al. evaluated the efficacy of PH adjusted bupivacaine in conjunction with medial orbital periconal block. they concluded that pH adjusted periocular anaesthesia is safe in patients undergoing intraocular surgery.[11] Col RP et al. evaluated the safety and efficacy of sodium bicarbonate and hyaluronidase in peribulbar anesthesia and concluded that sodium bicarbonate reduces the time of onset and successful block rates without any adverse effects.[12] Nazarullslam et al. found that sodium bicarbonate buffered Peribulbar block is faster than routine hyaluronidase augmented Block with a reduced time of onset of akinesia.[13]

2. Aim

A comparative study was conducted to know the effects to know effect of sodium bicarbonate and sodium hyaluronidase in peribulbar anesthesia for cataract surgery in SDEH, Hyderabad from a period of August 2016 to August 2018 as time bound study.

3. Objectives

To compare the results of sodium carbonate buffered lignocaine with hyaluronidase mixed lignocaine results.

3.1. Inclusion criteria

1. Patients with age 30-90 years
2. Either sex
3. Normal fundus
4. Normal IOP

3.2. Exclusion criteria

1. Patients with hearing defects, or profound cognitive impairment who are not able to understand.
2. Patients on preoperative sedatives, analgesics and anxiolytics.
3. Patients with documented allergies to hyaluronidase and lignocaine.
4. A detailed history was taken from the patients.

A through general examination was done, pulse rate and blood pressure was recorded for each patient. Ocular examination was done in detail.

The patients were randomly assigned into two of 250 patients each, Independent of age and sex, named as group A and group B.

Group A received injection from solution-1 and group B received injection from solution-2.

4. Materials and Methods

4.1. Preparation of anesthetic solution

1. **Solution 1)** 30 ml of lignocaine 2% with adrenaline 1:200000 was taken. to this 1 ml. sodium bicarbonate solution (0.299 mmol/m/) was added. pH was measured with electronic pH was measured with electronic pH meter as 7.2.
2. **Solution 2)** 30ml of lignocaine 2% with adrenaline 1:200000 was taken. I vial of hyaluronidase which contains 1500 IU/vial, was constituted using 2% lignocaine Itself and added to lignocaine bottle. This gives concentration of 50 IU/ml. The pH was measured with electronic pH meter as 4.6.

4.2. Procedure

Patients globe is kept in primary position. A 25-gauge needle of 1 inch is length is used. Injection site is at the junction of lateral 1/3 and medial 2/3 of lower lid first above the orbital rim through transcutaneous route. The bevel side is to be directed backward in sagittal plane tangential to the globe and parallel to floor of the orbit. After test aspiration, injection is slowly given. If slight proptosis and bulging of superonasal lid fold occurs, one can be almost sure of proper placement of anesthetic solution. Next pinky ball was applied intermittently and block was assessed.

4.3. Assessment of peribulbar block

4.3.1. Assessment of onset of akinesia

Effectiveness of block was assessed every minute for the akinesia of the extraocular muscles.

Time of onset for akinesia of extraocular muscles was taken as time at which any one of the extraocular muscles was paralyzed.

The time taken for the onset of complete globe akinesia. Final assessment of akinesia was made at 10 min. If there was inadequate akinesia (≤4) even after 10 minutes, the block was repeated. The requirement of repeat injection was considered as block failure.

4.3.2. Assessment of intra-operative analgesia

Patients were asked whether any pain was felt during surgery. If yes, the patients were asked to assess the severity as:

1. Sense of touch only.
2. Sense of pressure.
3. Discomfort.

Since the pain measured subjectively, the pain was assessed intraoperatively during various steps of surgery such as:

1. Superior rectus bridal suture.
2. Conjunctival incision.
3. Suturing of cornea-scleral incision.
4. Subconjunctival injection.

The complication of the block, if any were noted.

5. Observation and Results

This was a comparative study conducted to evaluate the efficacy of two anesthetic mixtures namely sodium bicarbonate buffered lignocaine and hyaluronidase mixed lignocaine in peribulbar block.

1. The 500 people are divided into 2 groups of 250 each.
2. Group A: 250 cases
3. Group B: 250 cases

Table 1: Age distribution

Age groups (years)	Group A (n=250)	Group B (n=250)	Percentage
30-39	03	10	2.6%
40-49	38	33	14.2%
50-59	78	67	2.9%
60-70	112	113	45%
>70	19	27	9.2%
Total	250	250	100%
Mean	58.19±10.46	59.93±10.98	

In this study patients were in age group from (30-90). Highest number of patients were in age group of 60-70 years.

1. 2.6% were in 30-39 years age group
2. 14.2% were in 40-49 years age group
3. 45% were between the age of 60 to 70.
4. 9.2% were in >70 years age group
5. Mean age was 58.6

5.1. Sex distribution

In Group A 118 males,132 were females. In Group B 120 males and 130 were females.

So total 262 were females and 232 were male patient included in this study.

5.2. Associated systematic illness

112 patients (22.4%) patients were hypertensive of which 58 were in Group A and 54 in Group B, 83 patients were diabetic of which 43 in Group A and 40 were in Group B and 23 patients (4.6%) has both diabetic and hypertensive.

5.3. Types of cataracts

Majority of the cases 366 (73.2%) were immature cataract of which 179 were in Group A and 1 87 were in Group B, 111(22.7%) had mature cataract of which 61 were in Group A and 50 were in Group B.

(2.4%) cases were hyper mature cataract 6 were in Group A and 6 in Group B.

Table 2: Time of onset of block

Time in minutes	Group A (Sodium bicarbonate)	Group B (Hyaluronidase)
1 min	90	63
2 min	121	131
3 min	27	45
4 min	09	05
5 min	03	06
Mean	1.86±0.83	2.04±0.85

In a Group A, 90 cases had onset of akinesia of any extraocular muscles at 1 minute, 121 cases at 2-minute, 27 cases at 3-minute, 9 cases at 4-minute, 3 cases at 5 minutes. The mean time for onset in Group A was 1.86±0.83. in Group B, 131 cases had onset at 2 minutes, 63 at 1 minutes, 45 cases at 3 minutes, 5 cases at 4 minutes, 6 cases at 5 minutes. Mean time of onset in Group B was 2.04±0.85.

Table 3: Time taken for total globe akinesia

Time in minutes	Group A	Group B
2 min	22	20
3 min	62	53
4 min	85	91
5 min	56	58
6 min	03	04
7 min	14	20
>7 min	02	–
Mean	4.02±1.24	4.13±1.24

In our study 89.4% cases operated had no pain, perception intra operatively remaining 10.6% cases had some degree of pain perception.

Table 4: Intraoperative analgesia

Intraoperative analgesia	Group A	Group B	Total (%)
No pain	226	221	447(89.4%)
Sense of Touch	07	10	17(3.4%)
Sense of Pressure	17	16	33(6.6%)
Discomfort	–	03	03(0.6%)
Total	250	250	500(100%)

17 cases (3.4%) had sense of touch of which 7 cases (41.1%) were in Group A and 10 cases (58.8%) in Group B, 33 cases (6.6%) have sense of pressure of which 17 were in group A and 16 were in Group B. Discomfort was experienced by 3 cases (0.6%).

Table 5: Anesthetic score

Anesthesia Score	Group A	Group B	Percentage
1	226	227	90.6%
2	18	19	7.4%
3	06	04	2%
4	250	250	100%

Table 6: Complications

Complications	Group A	Group B	Total (%)
Lid oedema	03	02	05(1%)
Chemosis	24	18	42(8.4%)
None	223	230	453(90.6%)
Total	250	250	500(100%)

In this study, 453 cases (90.6%) had no complications of these 223 (49.2%) in group A and 230 (50.7%) cases were in group B.

Lid edema was present in 5 cases (1%) of which 3(60%) were A and 2 (40%) were in Group B.42 cases (2.4%) had chemosis of which 24 were in Group A and 18 were in Group B.

6 patients in group A and patients in group B experimented inadequate anesthesia and so, block was repeated. About 3cc of anesthetic solution injected superaorbital region.

6. Discussions

Five hundred patients undergoing cataract surgery were included in our study.

These patients were assigned into Group A and Group B, each comprising of 250. Group A received block with Sodium Bicarbonate 7.5% mixed lignocaine solution and patients in Group B received peribulbar block with hyaluronidase mixed solution.

6.1. Age distribution

Cataract is more common in geriatric age group. In our study patients were in age group of 30-90 years. Highest number of patients were in age group of 60-70 years that is 45% followed by 29% in age group 50-59. Lowest number in age group 30-39.

Mean age group in our study was 58.76. In 2000, study by Srinivasan M,Vamshidhar M, Gopal K, Banushree patients age ranged from 20-79 years age was 58.2 years. This correlates with present day study.

In study done Col RP in 2006, highest number of patients were in age group of 50-60.

6.2. Present study

In 2009, study done by Kankanes et al. ages of patients ranged from 25-80 years. Mean age was 58.3 years. This also correlates with our study.[14]

6.3. Sex distribution

In one study there were 262 female cases and 232 male cases.

In study by Srinivasan M et al, they were 53 cases (47.32%) males and 59 (52.67%) cases were female.[9]

In study done by Minasian MC et al, 25 cases (41.67%) were males and 35(58.3%) cases were female. This correlates with present study.[15]

Associated systemic diseases.

In our study 112 patients had systemic hypertension, 83 cases had diabetes, and 23 had both hypertension and diabetes.

In study done by Edge KR et al. 12500 cases receiving retrobulbar block were studied.[16] They found that acquired vascular diseases are a significant risk factor for the development of complications.

6.4. Type of cataract

In this study, Immature cataracts were predominantly (73.2%), 22.2% had mature into active screening for cataracts and increased amount of awareness of cataracts amongst general population.

6.5. Onset of akinesia

In our study, onset time for akinesia of any extraocular muscle ranged from 1-5 mins in both groups. The mean time for onset of akinesia for any extraocular muscle in group A was 1.86+ and group B was 2.04±0.85.

Col RP, Maj G Kapoor evaluated safety and efficacy of sodium bicarbonateversus Hyaluronidase in peribulbar anesthesia and found that time of onset of akinesia was statistically significant.[12]

Islam MN et al. compared sodium bicarbonate and sodium hyaluronidase in ocular regional anesthesia and

concluded that sodium bicarbonate buffered peribulbar block is faster than routine hyaluronidase augmented block with reduced time of onset of akinesia.[13]

6.6. Total globe akinesia

Time taken for total global akinesia in group A is 4.02 +1.24 and in group B it is 4.13+1 24 This was not statistically significant Lewis P et al. concluded that there was no difference in time taken for total globe akinesia.[17]

6.7. Intraoperative analgesia

In this study 89.4% cases had no pain perception intraoperatively, 3.4% cases experienced sense of touch of which 14.1% were in Group A and 58.8% were in group B 6.6% had sense of pressure of which 51.5% were in a group A and 48.4% were in Group B 6.6% had sense of pressure of which 51.5% were in group A and 48.4% were in group B. Discomfort was experienced by 0.6% patients. The results are not statically significant.

6.8. Anesthesia scoring

90.6% patients had grade 1 anesthesia, of which 49.8% were in group A 50.1% were in group B, 7.4% cases had grade 2 of which 48.6% were in group A and 51.35% were in group B, 7.4% were in group B.2% cases had grade 3 of which 60% were in group A and 40% were in group B.

In Col RP study 78% cases in group hyaluronidase and 81.5% in bicarbonate group had grade 1 anesthesia. This correlates with present study.

6.9. REBLOCK

6 patients in group A and 4 patients in group B experienced inadequate anesthesia so block was repeated, by injecting 3cc anesthetic solution inferotemporal.

In study done by sozhamadevi (2018) repeat block rate in sodium bicarbonate group was 4.6% and 2% in hyalase group.

In study done by Col RP 3% in hyaluronidase group and 4% in bicarbonate group required supplemental block. This correlates with present study.

6.10. Complications

In this study 90.6% had no complications, these 49.2% were in group A and 50.7% were in Group B.8.4% had chemosis of these, 57.14% were in group A and 42.8% were in group B.

Lid edema was found in 1% of cases of which 3 cases were in group A and 2 were in group B. There were no major systemic complications recorded in both groups. There was no incidence of any globe perforation or nerve injury, thus conjunctival chemosis is most common complication encountered in our study, slightly more common in group A than group B, although it is not statistically significant.

In study done by Col RP chemosis was common complications.[12]

7. Conclusion

Senility is commonest cause of cataract with sight female preponderance. Sodium bicarbonate was shown to reduce the time of onset of the block. Intraoperative analgesia is also comparable in both groups. Chemosis is the common complication encountered following peribulbar block, noted slightly more common in sodium bicarbonate group although it is statistically not significant. As sodium bicarbonate is cheaper, provides reasonable alternative.

8. Source of Funding

None.

9. Conflict of Interest

None.

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