



Original Research Article

Study of pain in peribulbar anesthesia with buffered and nonbuffered agents

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ABSTRACT

Since many years anesthesia for an eye evolving from retrobulbar to topical. Hyaluronidase is used for better absorption of anesthetic solution. Due to the enzyme nature of hyaluronidase, cost of the drug, risk of anaphylaxis and limited shelf life led the search of newer molecule which gives better absorption with negligible risk and cost effectiveness. As commercially available local anesthetic agents are more acidic in nature causing more pain to patients and so this study compares the pain perception by buffering the anesthetic agents with sodium bicarbonate 7.5%.

Objective: To estimate the pain perception of preservative free sodium bicarbonate (7.5%), lignocaine 2%, bupivacaine 0.5% with hyaluronidase (1500IU) in combination of lignocaine 2% and bupivacaine 0.5% for peribulbar anesthesia.

Materials and Methods: Prospective interventional study was done on 60 patients over a period of 12 months. Patients were selected randomly who falls under inclusion criteria and were injected freshly prepared non-buffered (solution-A) or buffered (solution-B) peribulbar anaesthesia. The pH of both solutions was tested using digital pH meter at the same time. All peribulbar injections were given by one surgeon only. The pain of peribulbar injection were noted on Wong-Baker FACES²⁰ pain rating scale during each block. Results were analyzed by independent t - test.

Results: Both the groups consist of 30 patients each. 34 were male and 26 were female. Mean pH of solution A: 6.18 ± 0.13 and of solution B: 7.18 ± 0.14 . In first group that is without sodium bicarbonate 40% of patients were having a moderate pain with mean pain score $4.033 + 2.12$ and 6.66% of patients were having moderate pain with mean pain score $1.43 + 1.40$ in the second group (with sodium bicarbonate). Statistical analysis shows P value 0.00001, which was highly significant.

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1. Introduction

Good analgesia and akinesia without any local or systemic complication achieved by effective and safe anesthesia. For a better surgical outcome, the pre-requisite for an eye surgeon is to achieve good surface anesthesia, akinesia and hypotony. The complications of retrobulbar block can be avoided without any additional prick for facial block with the help of peribulbar block. Sensory and motor nerve blockade cause the anesthesia and akinesia to occur and the hypotony is achieved by the loss of tone of extra ocular muscles.

The anesthetic solution contains 2% lignocaine and 0.5% bupivacaine. Their mechanism of anesthesia is by the process of diffusion. Hyaluronidase is used for the better diffusion of anesthetic solution.¹ This enzyme acts by the depolymerization of hyaluronic acid to tetra saccharide which causes the interstitial barrier to liquify.¹ It thereby facilitates the diffusion of anesthetic solution. But it has acidic pH which causes pain. Galindo et al (1983)^{2,3} Zahl K et al,⁴ McKay et al⁵ demonstrated that increasing the pH of lignocaine by adding sodium bicarbonate decreases pain on injection,⁵ these studies investigated this effect in skin infiltration. There were very few studies done till now to estimate the effect of pain with acidic and alkalinized solution of peribulbar anesthesia. Hence in

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present study evaluated the pain scoring with hyaluronidase versus sodium bicarbonate.

2. Materials and Methods

This is a prospective interventional study was carried out in tertiary care centre of South Gujarat region after ethical clearance from ethical committee and patients informed consent. Total 60 patients were enrolled in the study and were randomly given freshly prepared anesthetic solution and were assigned in two group A, and B.

Group A: Solution A (non-buffered solution) prepared by using 5ml of 2% lignocaine with hyaluronidase (50IU/ml of hyaluronidase) and 5ml of 0.5% bupivacaine. (Total 10ml)

Group B: Solution B (buffered) prepared by using 5ml of 2% lignocaine and 4ml of 0.5% bupivacaine and one ml of 7.5% preservative free sodium bicarbonate to make it ten ml

2.1. Inclusion criteria

Each patient who gave consent to enroll in this study undergoing cataract surgery without any systemic illness.

2.2. Exclusion criteria

1. Patients on drugs like anxiolytics, pre-operative sedatives, analgesics were avoided.
2. The patients with severe cognitive impairment who were unable to explain grading of pain.
3. Apprehensive patients.
4. Patient with known allergy to hyaluronidase and lignocaine.
5. Patients with vitreo-retinal disease and heart disease were excluded.

2.3. Examination

Patients history, ophthalmological examination including vision, slit lamp biomicroscopy, fundoscopy, biometry, IOP measurement, sac syringing was done preoperatively along with systemic and general checkup. Stability of pH was maintained by freshly preparing anesthetic agents at the beginning of each operating list. At each time the pH-meter is calibrated and pH of freshly prepared solution is noted.

All peribulbar injections were given by single surgeon. The method of peribulbar anesthesia was explained to the patient and was placed in supine position on an operating table and asked to fixate on ceiling. Anesthetic solution was injected at the infero temporal quadrant, total 6-7cc at the inferior orbital notch of the lower lid using one inch 24-gauge needle. Patients with lid movement were given an additional injection of the same mixture at the end of 5 minutes at superior orbital notch of the upper lid. The pain of peribulbar injection on Wong- Baker FACES²⁰ pain rating scale were noted. Patients were operated for cataract extraction by phacoemulsification or manual small incision

cataract surgery.



Fig. 1: Wong-Baker FACES Pain Rating Scale²⁰

Pain rating scale was graded as follows:

0 to 4- mild

5 to 8- moderate

>= 9- severe

2.4. Statistical Method

All the recorded data were analyzed for patients' demographic profile. The pain score was analyzed by independent t test. Software used for statistical analysis is Epi Info software.

3. Results

Each group has thirty patients most of them were of more than 60 years. As cataract is more common in this age group. Out of 60 patients 26 were female and 34 were male. Mean pH of solution A: 6.18 + 0.13 and Mean pH of solution B: 7.18 + 0.14.

In group A 17 patients were having mild pain, and 13 were having moderate to severe pain as compare to group B where only 2 patients have moderate pain and 93.31% of patients were having mild pain.

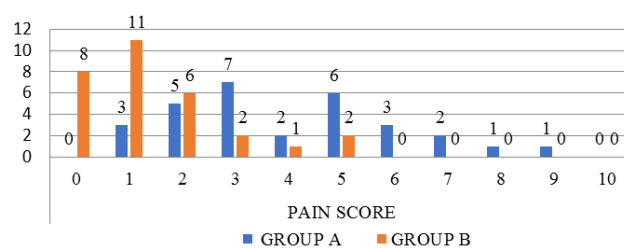


Fig. 2: Analysis of pain score

Most of (28) the patients were having mild pain in buffered group and their mean pain score was 1.43 + 1.40 as compare to group A has 4.033 + 2.12. The two tailed p value was < 0.00001 which was statistically significant.

4. Discussion

Local anaesthetics acts by crossing the perineural sheath and nerve membrane, these structure are only permeable to the drug in its non-ionized form.⁶ Most local anaesthetics

Table 1: Distribution of the subject under study as per age

Age of the patients	(Group A) patient	Percentage (%)	(Group B) patient	Percentage (%)
<40 years	01	3.33%	00	0%
40-60 years	11	36%	13	43.33%
>60 years	18	60%	17	56.66%
Total	30	100	30	100

Table 2: Grades of pain score in both groups:

Pain score	Group A	% of group A	Group B	% of group B
MILD (0-4)	17	56.66%	28	93.31%
MODERATE (5-8)	12	40%	2	6.66%
SEVERE >9	1	3.33%	0	0%

Table 3: Comparison of mean pain score in two treatment groups:

Group	Mean pain score
A(non buffered)	4.033 + 2.12
B(buffered)	1.43 + 1.40

are weak bases with pH ranges from 7.7 to 8.9, though they are supplied in acidic solution⁶ for the purpose of their stability. Buffering of solution with bicarbonate increases the amount of the non-ionized form.^{7,8} Many studies have recorded for comparisons between buffered and plain anaesthetic solution.^{6,7,9,10} Many causes for the reduction in pain with alkalinisation of the anaesthetic solution have been found. Alkalinisation of anaesthetic solution achieved by adjusting its pH towards physiological range which thereby reduces the local tissue irritation. Commercially available lignocaine with out adrenaline (pH 4.15) has a lower pH and is more painful than lignocaine with adrenaline(pH6.4).^{5,11,12} One should observe for the precipitation while preparing the fresh anaesthetic solution. Bupivacaine can be safely alkalinized to a pH of 7.0 – 7.4 without any risk of precipitation,¹¹ lignocaine is stable at a slightly higher pH of 7.54¹² In present study there was no problem of precipitation at mean pH of 7.18 ± 0.14.

Zahl et al in 1991¹³ have done study on the effect of bicarbonate on mixtures of lignocaine, bupivacaine and hyaluronidase with or without epinephrine in peribulbar anaesthesia. The author concluded that pH adjustment of solution with bicarbonate could be painless, well tolerated and safe method which effectively achieves akinesia and shortens the onset of anesthesia compared to lidocaine and hyaluronidase combination providing a cost-effective alternative.¹⁴

Meg C Minasian et al studied¹⁵ relation between pH of anaesthetic solution and patient pain perception with peribulbar injection of standard local anaesthesia at pH 4.87 or an alkalinized solution with addition of 8.4% sodium bicarbonate at pH 7.44. Meg C Minasian study concluded that the mean pain score of two treatment groups were near to similar. Higher in who received the

pH adjusted solution, compared to who received the plain solution. The small difference was not significant. His study showed no difference in the reduction in the pain.

In present study the mean pH of solution A was 6.18 ± 0.13 and solution B was 7.18 ± 0.14 and mean pain score was 1.43 + 1.40 as compare to group A has 4.033 + 2.12. The two tailed p value was < 0.00001 which was statistically significant.

Absence of hyaluronidase increases the risk of pain during injection, postoperative strabismus and diplopia found out by American academy of ophthalmology in 2001.¹⁶ As the study was not accepted widely further research requires to establish fact. Galindo et al had reported that by alteration of the pH of local anesthetic solution the time of onset and spread of neural blockade could be increased significantly.¹⁷ Gupta R P, Kapoor G¹⁸ in 2006 studied for the Safety and Efficacy of Sodium Bicarbonate versus Hyaluronidase in Peribulbar Anesthesia and concluded that Sodium bicarbonate reduce d the time of onset and increase the successful block rate without any side effects. In 2016, Dr. Sachin, Dr. Siddarth¹⁹ studied for Sodium bicarbonate as an alternative to hyaluronidase in ocular anesthesia during cataract surgery and conclude that the use of sodium bicarbonate with LA for cataract surgery is safe, effective and economical.

Our study also found sodium bicarbonate 7.5% safe, painless and economical alternative to hyaluronidase.

5. Conclusion

Addition of sodium bicarbonate 7.5% to mixture of lignocaine 2% with bupivacaine 0.5% is safe, painless and cheap alternative to sodium hyaluronate.

6. Source of Funding

None.

7. Conflict of Interest

None.

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