Original Article

Safety and Efficacy of Sodium Bicarbonate versus Hyaluronidase in Peribulbar Anaesthesia

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Abstract

Background: 400 cases undergoing surgery for cataract under local anaesthesia were studied. Peribulbar anaesthesia involves injecting a mixture of 2% lignocaine, bupivicaine 0.5% and hyaluronidase into the peripheral space of the orbit through a single infero-lateral point. Sodium bicarbonate has been shown to reduce the time of onset of anaesthesia and pain perception when mixed with local anaesthetics.

Methods: This study compared two groups of patients (200 each), one receiving hyaluronidase mixed anaesthetic and the other sodium bicarbonate buffered anaesthetic. The groups were compared for effectiveness of the anaesthesia, its onset, duration and the final visual outcome.

Results and Conclusion: Sodium bicarbonate was shown to reduce the time of onset and increase the successful block rate without any adverse affects.

MJAFI 2006; 62 : 116-118

Key Words : Sodium bicarbonate, Peribulbar, Hyaluronidase.

Introduction

The goals of safe and effective anaesthesia for intraocular surgery are to obtain adequate anaesthesia and akinesia without complications. In 1949, Atkinson reported the advantages of using Hyaluronidase in anaesthetic solutions to achieve early akinesia and anaesthesia [1]. Hyaluronidase catalyses the depolymerisation of hyaluronic acid to a tetrasaccharidde and leads to liquefaction of the gelatinous interstitial barrier [2]. However, there is no evidence for increased spread across fascial planes [3,4]. Galindo et al [5] reported that by altering the pH of the local anaesthetic solution with sodium bicarbonate, in a 1:10 mixture with lidocaine or bupivicaine, the time of onset could be reduced and the spread of neural blockade enhanced significantly. The alkaline form of the drug is active and alkanisation with sodium bicarbonate increases the non-cation form of the drug [6,7]. Zahl K et al postulated that the non-cation form penetrates the soft tissue and nerve sheath faster resulting in decrease in duration of the onset of action [7]. The ability of local anaesthetic solution to decrease onset time for neural blockade has been demonstrated by Hilgier on brachial plexus anaesthesia [8]. McKay et al demonstrated increasing the pH of lidocaine by adding sodium bicarbonate decreases pain on injection [9]. However there is no study evaluating bicarbonate as replacement for hyaluronidase in ocular anaesthesia. Recently some studies have doubted the efficacy of hyaluronidase [10].

Material and Method

400 patients for surgery under local anaesthesia were considered for this study. The patients were randomly assigned into 2 groups. Group 1 was injected with an anaesthetic mixture containing 0.5% bupivicaine (3cc) and 2% lignocaine (3cc) with hyaluronidase (1500 IU in 30cc of lignocaine). Group II was injected anaesthetic mixture containing 0.5% bupivacaine (3cc) and 2% lignociane (3cc) with 7.5% sodium bicarbonate (1ml in 30cc of lignocaine). Patients on preoperative sedatives and anxiolytics, patients with profound cognitive impairment who were unable to grade pain and cases undergoing squint, retinal detachment surgery and dacryocystorhinostomy were excluded. Single point peribulbar anaesthesia was administered by a single person who was unaware of the constituents of the mixture at the inferotemporal quadrant in all the cases and a total of 6cc injected at the junction of medial 2/3 and lateral 1/3 of the lower lid with eye in primary position of gaze. Grading of anaesthesia and akinesia was as below [11]-

a) Grade 1- Complete anaesthesia and akinesia as demonstrated by:
   i) Complete absence of eye movements
   ii) Complete anaesthesia of cornea and conjunctiva
   iii) Painless insertion of superior rectus bridle suture
b) Grade 2 – Akinesia and anaesthesia considered adequate for safe intraocular surgery as demonstrated by:

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Received : 21.11.2003; Accepted : 25.05.2005

i) Eye movements less than 15° in any direction of gaze

ii) as above and iii) as above

c) Grade 3- Unsuccessful akinesia and anaesthesia as judged by:

i) Eye movements more than 15° in any gaze

ii) Painful insertion of superior rectus bridle suture

Patients with grade 3 anaesthesia were given a supplement injection of the same mixture after 10 minutes at the junction of medial 1/3 and lateral 2/3 of the upper orbital margin (just inferomedial to supra orbital notch). The time taken to onset of anaesthesia and akinesia was time from the point of injection to the development of absence of ocular movements. Ocular movements were checked initially after 4 minutes and then every minute till there was evidence of diminution of ocular movements. Patients were observed for any untoward systemic side effects. Postoperative follow-up was done on days 1 and 2 and 2, 4 and 8 weeks final best when corrected visual acuity recorded.

Results

In Group I, 86 patients (43%) and in Group II, 91 patients (45.5%) were in the age group of 50-60. In Group I, 84 (42%) patients and in Group II, 78(39%) patients underwent phacoemulsification. In group I, 32 (16%) patients had an onset of anesthesia within 5 minutes. 106 (53%) between 5-10 minutes, 51(25.5%) between 10-15 minutes and 11(5.5%) after 15 minutes. In group II, 55 (27.5%) patients had onset with 5 minutes, 118 (59%) between 5-10 minutes, 18(9%) between 10-15 minutes and 9 (4.5%) after 15 minutes. In Group I, 156 (78%) patients had Grade I and 38 (19%) had Grade II anaesthesia. In Group II, 163 (81.5%) had Grade I and 33 (16.5%) had Grade II anaesthesia. All the patients given supplement achieved Grade I anaesthesia. In Group I, 178 (89%) patients had a duration of anaesthesia between 30-90 min and 22(11%) patients a duration more than 90 min . In Group I, 149 (74.5%) patients achieved a best corrected visual acuity (BCVA)greater than 6/18. In group II, 143 (71.5%) patients had a BCVA between 6/6 to 6/18. The reasons for the low visual acuity in both the groups included age related macular degeneration (ARMD), decentered intraocular lens (IOL), high astigmatism and intra-operative vitreous loss. There were no major systemic or ocular adverse effects recorded after the administration of anaesthesia and in the post operative period. The most common side effect seen was chemosis, which was present in 34 (17%) patients in Group I and 31(15.5%) in Group II. Vitreous bulge and forward thrust was also seen 4 cases in each Group. Haemorrhage was seen in 7 patients in Group I and 5 patients in Group II. This was manifested as a periocular ecchymosis which came up after surgery or on the 1st post-op day.

Discussion

Studies conducted by Rao et al (1996), Dempsey GA (1997), Cost P et al (1999) and Rowley SA et al(2000) confirmed the usefulness of hyaluronidase in ocular anaesthesia [12,13,14,15]. In this study, we compared the onset and effectiveness of peribulbar anaesthesia with hyaluronidase and sodium bicarbonate. The mean time to onset in group I was 8.6 min whereas in group II, it was 7.1 min. The P value was <0.0005, thus the result is statistically significant. The above results were also analysed by conversion into a 2x2 table, i.e. onset>10 min and onset < 10 min and chi square test by taking difference between two proportions, which showed a higher proportion and faster onset in the group receiving Sodium Bicarbonate and the value of p<0.005 (Table 1). Both the groups achieved similar results with regard to grading of anesthesia (Table 2). In Group I, 6 (3%) patients required a supplemental block whereas, in Group II, 4 (2%) needed a supplemental block. In Group I the successful block rate was 97% and in Group II, 98%. The difference in results between the two groups is not statistically significant. In Group I, 192(96%) patients had duration of anesthesia of more than 30 min (Table 3) and in Group II, 179 (89.5%). The duration of anesthesia was independent of the agent.

Table 1

Time to onset of anaesthesia

Time in onset of anesthesia	Gruop I (with hyaluronidase)	Group II (with sodium bicarbonate)
0-5 mins	32	55
6-10 mins	106	118
11-15 mins	51	18
> 15 mins	11	9

Table 2

Grading of anaesthesia

Grading of anesthesia	Group I (with (hyaluronidase)	Group II (with sodium bicarbonate)
Grade I	156	163
Grade II	38	33
Grade III	6	4

Table 3

Duration of anesthesia

Duration of anesthesia	Group I (with hyaluronidase)	Group II (with sodium bicarbonate)
< 30 min	8	11
30-90 min	178	167
> 90 min	14	22

The local anaesthetic used had little, impact on the final visual acuity of the patient. There were no major systemic complications recorded in the two groups. There were some cases of peribulbar/subconjunctival haemorrhage, vitreous bulge and forward thrust. There was no incidence of any globe perforation or nerve toxicity. The incidence of complications was similar in both the groups, with no significant difference.

Conflicts of Interest

None identified

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