

Comparison of Alkalinized and Plain Lignocaine on Injection Pain in Peribulbar Block-A Randomized Trial

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ABSTRACT

Background: Pain during peribulbar anesthesia is commonly attributed to the acidic pH of local anesthetic solutions. Alkalinization increases the non-ionized fraction, improving tissue diffusion and reducing nociceptor sensitivity, thereby minimizing injection pain.

Methods: In this prospective, randomized, double-blind trial, 80 patients scheduled for cataract surgery under peribulbar anesthesia were assigned into two groups. Group A received a standard anesthetic mixture, while Group B received the same mixture alkalinized with 7.5% sodium bicarbonate. Pain was assessed using a 10 cm visual analogue scale. Surgeon satisfaction and the need for supplemental anesthesia were also evaluated. Statistical analysis was performed using the Student's t-test, with significance at $p < 0.05$.

Results: The groups were comparable in terms of age and gender. The mean pain score in Group B (alkalinized lignocaine) was significantly lower at 1.15 (SD 1.3) compared to 2.05 (SD 1.8) in Group A (plain lignocaine) ($p = 0.012$). No significant differences were noted between groups regarding supplemental injections or surgeon satisfaction.

Conclusion: Alkalinization of local anesthetic for peribulbar block significantly reduces injection pain without compromising anesthetic efficacy or surgeon satisfaction. Incorporating this technique can enhance patient comfort during cataract surgery.

Key-words: Alkalinization, Cataract surgery, Injection pain, Local anesthesia, Peribulbar block, Visual analogue scale

INTRODUCTION

Peribulbar anesthesia is a widely accepted technique for providing regional anesthesia during cataract surgery, offering excellent akinesia and analgesia with a favorable safety profile [1]. However, pain during the injection of local anesthetic remains a frequent concern, mainly due to the acidic nature of the anesthetic solutions used to maintain drug stability [2]. In acidic environments, local

anesthetics exist predominantly in an ionized form, which may cause direct tissue irritation and enhance pain perception [3,4].

Alkalinization of local anesthetics by adding sodium bicarbonate has been proposed to address this issue. This adjustment increases the proportion of the non-ionized form, facilitating more rapid tissue diffusion and leading to a faster onset of sensory blockade [5,6]. Additionally, nociceptor receptors are believed to be less sensitive to the non-ionized form of the anesthetic, further decreasing injection pain [3,7].

Previous studies have demonstrated that alkalinized solutions reduce the discomfort associated with local anesthetic infiltration in various surgical procedures, including ophthalmic blocks [5,8]. Furthermore, it has

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been reported that alkalization can be performed safely without causing precipitation if pH adjustments are carefully controlled, particularly with agents like lignocaine and bupivacaine ^[9,10].

This study aims to compare pain perception during peribulbar anesthesia using plain versus alkalized lignocaine solutions in patients undergoing cataract surgery and to evaluate the clinical benefits of this simple modification in anesthetic practice. To achieve this, we conducted a prospective, randomized, double-blind trial comparing the effects of alkalized and plain 2% lignocaine on self-reported block pain during cataract surgery.

MATERIALS AND METHODS

Research Design- A prospective, randomized, double-blind clinical trial was performed to compare the effects of alkalized versus plain lignocaine on injection pain during peribulbar block in cataract surgery patients.

Inclusion Criteria

- Patients scheduled for elective cataract surgery under peribulbar anesthesia.
- Age above 20 years.
- Patients willing to provide informed consent.

Exclusion Criteria

- Patients younger than 20 years.
- History of previous intraocular surgery under local anesthesia.
- History of antipsychotic, antidepressant, or antianxiety drug use.
- Known mental retardation.
- Known allergy to lignocaine or bupivacaine.
- Monocular (one-eyed) patients.

Sample Size and Group Allocation- A total of 80 patients were enrolled and randomly divided into two groups:

- ❖ **Group A-** Received 4 mL of 2% lignocaine + 2 mL of 0.5% bupivacaine with hyaluronidase (1500 IU in 30 mL of lignocaine) (pH 5.4–5.6).
- ❖ **Group B-** Received the same anesthetic mixture as Group A, additionally alkalized with 7.5% sodium bicarbonate (1 mL in 30 mL lignocaine) (pH 7.0–7.2).

Procedure- Peribulbar block was administered by the experienced optometrist blinded to group allocation.

Pain assessment was performed using a standard 10 cm Visual Analogue Scale (VAS), enlarged to A4 size to aid visually impaired patients. Surgeon's satisfaction regarding anesthesia quality was documented after surgery.

Statistical Analysis- Continuous variables were expressed as Mean±Standard Deviation (SD). The students' t-test was used to make intergroup comparisons. A p-value<0.05 was considered statistically significant.

Ethical Approval- The study protocol was approved by the Institutional Ethical Committee. Before enrollment, written informed consent was obtained from all participants, and the study was conducted following the Declaration of Helsinki.

RESULTS

A total of 80 patients were enrolled and randomly allocated into two groups. The demographic characteristics including age and gender were comparable between Group A and Group B, with no statistically significant differences (Table 1).

Table 1: Demographic characteristics of study participants

Variable	Group A (Plain Lignocaine)	Group B (Alkalized Lignocaine)	p-value
Mean Age (years)	61.2±8.5	62.1±9.1	0.58
Gender (Male/Female)	23/17	22/18	0.82

The mean pain score assessed on the Visual Analogue Scale (VAS) was significantly lower in Group B (alkalized lignocaine) compared to Group A (plain lignocaine) (Table 2).

During surgery, four patients in each group required supplementary injections due to inadequate anesthesia. No significant differences were observed between the two groups regarding the requirement of supplementary injections or surgeon satisfaction scores (Table 3).

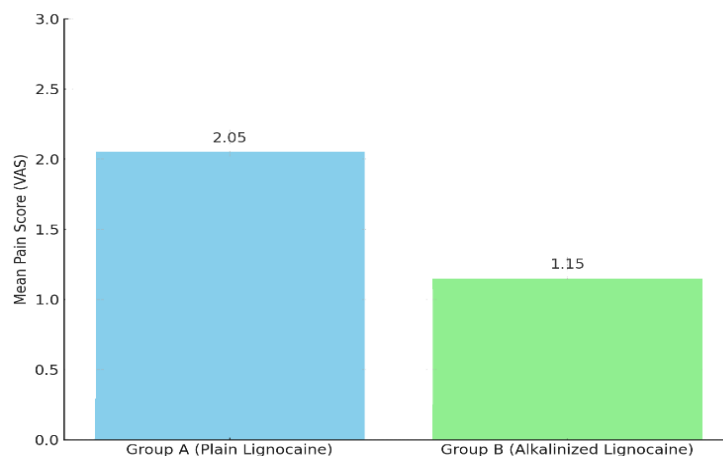
Table 2: Comparison of Pain Scores Between Groups

Variable	Group A (Plain Lignocaine)	Group B (Alkalinized Lignocaine)	p-value
Mean Pain Score (VAS)	2.05±1.8	1.15±1.3	0.012

Table 3: Supplementary Injection Requirement and Surgeon Satisfaction

Variable	Group A (Plain Lignocaine)	Group B (Alkalinized Lignocaine)	p-value
Supplementary Injection (n)	4	4	1.00
Surgeon Satisfaction (Mean Score)	4.7±0.6	4.8±0.5	0.38

The mean pain scores between the two groups are graphically represented in Fig. 1.

**Fig. 1:** Comparison of Mean Pain Scores Between Groups

DISCUSSION

The findings of our study demonstrate that the alkalinization of lignocaine significantly reduces injection pain during peribulbar anesthesia in cataract surgery patients. Similar observations have been reported in previous studies where pH adjustment of local anesthetics resulted in decreased patient discomfort during infiltration^[11,12].

Alkalinized solutions increase the proportion of non-ionized drug molecules, facilitating faster penetration across nerve membranes, and thereby producing a more rapid and effective nerve blockade^[13]. This mechanism not only accelerates the onset of anesthesia but also diminishes direct tissue irritation caused by acidic solutions^[14].

Our results are consistent with the study by Jaichandran *et al.* who reported that alkalinized lignocaine significantly reduced pain scores during ophthalmic

blocks without affecting the block quality^[15]. Similarly, Colaric *et al.* demonstrated that buffered lignocaine reduced injection pain in various clinical settings^[16].

Despite a significant reduction in pain scores, there was no statistically significant difference in the number of supplementary injections required or surgeon satisfaction between the two groups in our study. This finding is supported by other trials suggesting that while alkalinization improves patient comfort, the quality of the block may depend on multiple other factors like injection technique, drug volume, and individual pain thresholds^[17,18].

One limitation of our study was the relatively small sample size and subjective assessment of pain, which might introduce bias. Future studies with larger sample sizes and objective pain assessment methods are recommended to validate these findings. Thus, the alkalinization of lignocaine offers a simple, cost-effective

modification to improve patient experience during peribulbar anesthesia without compromising surgical outcomes.

CONCLUSIONS

The alkalinization of lignocaine significantly reduces pain during the administration of peribulbar block without compromising the effectiveness of anesthesia or surgeon satisfaction. This simple modification enhances patient comfort during cataract surgery and can be easily incorporated into routine anesthetic practice. Wider adoption of this technique is recommended to improve patient experiences during ophthalmic procedures.

CONTRIBUTION OF AUTHORS

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