ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 16, Issue 4, 2023

Online - 2455-3891
Print - 0974-2441

Research Article

ROLE OF DEXMEDETOMIDINE AS AN ADJUVANT TO LIDOCAINE AND BUPIVACAINE COMBINATION AS LOCAL ANESTHETICS IN PATIENTS UNDERGOING EXTERNAL DACRYOCYSTORHINOSTOMY

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Received: 15 January 2023, Revised and Accepted: 15 February 2023

ABSTRACT

Objective: The objective of the present study is to review the role of dexmedetomidine, its safety and efficacy when added to lidocaine and bupivacaine mixture to obtain local infiltration anesthesia (LA) in external dacryocystorhinostomy (DCR).

Methods: A double-blind study was conducted to assess the role and efficacy of dexmedetomidine added to lidocaine and bupivacaine mixture to obtain local infiltration anaesthesia in External Dacryocystorhinostomy. In Group A of 32 patients 20 µg dexmedetomidine was added to 3.5 mL lidocaine 2% without epinephrine and bupivacaine 0.5% mixture as a local anesthetic. In Group B of 32 patients 3.5 mL of lidocaine 2% without epinephrine and bupivacaine 0.5% mixture alone was used as local anaesthetic. The onset and the duration of sensory blockade as well as intraoperative sedation were verified. Visual analog score was used to evaluate the post-operative pain during the 12 h postoperative period. Anesthesia-related intra-operative complications and patient satisfaction were observed.

Results: Group B patients developed Anaesthesia in short duration; duration of the anesthetic effect was for long period than in the Group A (p-value was 0.015 and 0.0001, respectively). The Visual Analog Scale score of the analgesia during the post-operative period was much lower (0–3) in the study Group B than in the Group A patients (4 and 5). These values were recorded after 6th and 8th hours postoperatively with p-values at 0.002 and 0.031, respectively.

Conclusion: Dexmedetomidine added to the local anesthetic agents acts as an adjuvant to produce an early sensory block, extended nerve block time, and post-operative analgesia without side effects and complications. Extended post-operative analgesia was associated with increased intraoperative sedation. Subjective satisfaction of the patients was achieved without side effects. Keywords: Lacrimal apparatus, Dacryocystorhinostomy, Local anesthetic, Sedation, Analgesia and Dacryocystorhinostomy.

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 DOI: http://dx.doi.org/10.22159/ajpcr.2023v16i4.49446. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Obstruction in the lacrimal apparatus was treated from time immemorial by bypassing the flow of tears by creating a communication between the lacrimal sac and the inferior meatus of the nasal cavity; through an external approach [1]. The procedure was earlier performed under general anesthesia [2]. Nowadays, it is commonly done under local anesthesia (LA) [3]. Under general anesthesia, control over blood loss was good unlike in LA [4]. Similarly, inadequate local anesthetic block creates a concern while performing dacryocystorhinostomy (DCR) under LA [5]. Undertaking DCR under LA has its advantages in minimizing the systemic complications and prolonging post-operative analgesia and aspiration [6,7]. To further increase the analgesia and sedation while undertaking DCR under LA, drugs such as dexmedetomidine are being used [8,9]. As there are insufficient reports of using the combination of lidocaine and dexmedetomidine, this study was undertaken to study the role of dexmedetomidine, its safety, and efficacy when added to lidocaine to obtain LA in external DCR.

METHODS

Type of study

This was a randomized, double-blind study.

Institute of study

The study was conducted by the Government Medical College and General Hospital, Anantapuramu, Andhra Pradesh, India.

Period of study

The study period was June 2021–December 2022.

Sixty-four patients attending the department of ophthalmology with the diagnosis of obstruction to the lacrimal apparatus were included in this study. An institution ethics committee clearance was obtained. Ethics committee approved consent form and pro forma were used in the study. Patients were divided into two groups. All the patients were selected for external DCR surgery under LA. Group A consisted of 32 patients in whom lidocaine 2% + bupivacaine 0.5% mixture was used as an anesthetic agent along with 1 ml of 9% normal saline. This was considered as a control group. In Group B, lidocaine 2% + bupivacaine 0.5% mixture was used as an anesthetic agent; 1 mL of saline and normal saline containing 20 µg Dexmedetomidine was used. This group was considered as study group. The selection of patients to each group was done by a random method downloaded from the internet using randomnumber.org.

Inclusion criteria

Patients aged between 18 years and 60 years were included in the study. Patients of both genders were included in the study. Patients diagnosed by lacrimal syringing to have blockage of lacrimal canaliculi were included in the study. Patients with blockage of the common canalicular duct were included in the study.

Exclusion criteria

Patients aged below 18 and above 60 years were excluded from the study. Patients with acute infection of the lacrimal apparatus were excluded

from the study. External DCR revision cases were excluded from the study. Patients with a history of local trauma to the site of incision were excluded from the study. Patients with systemic diseases which delay the healing were excluded from the study. Patients with a history of coagulopathy, uncontrolled systemic disease, unconsciousness as well as uncooperative patients were excluded from the study. The anesthetic mixture was arranged in identical syringes and introduced in the sealed package by an independent anesthesiologist. During the immediate post-operative period, the following parameters were noted: Oxygen saturation, blood pressure (BP), and electrocardiogram.

Procedure

The sites of local infiltration equal injections of LA (2 mL each) were given to infratrochlear area, infraorbital area, 5 mm above the medial canthal tendon to a depth of 15–20 mm, and subcutaneously beneath the site of incision at the side of the nose. For nasal anesthesia, tetracaine-oxymetazoline nasal spray was used in the ipsilateral nasal cavity to produce anesthesia and decongestion of the nasal mucosa. Effectiveness of the local infiltration was tested at intervals of 1, 3, 5, 7, 9, and 10 min using needle prick sensation. If there was no anesthesia even after 20 min, the procedure was considered as a failure. Such cases were operated under general anesthesia; such patients were excluded from the study. (1) The time taken for loss of needle prick sensation after the infiltration was noted. (2) Time interval after that and starting of post-operative pain was noted, considered as the duration of local anesthetic infiltration. During the post-operative period, a Visual Analog Scale with 1–5 points was used to assess the grading of pain severity. Pain evaluation was done up to 4 h from starting of the infiltration anesthesia and later every 2 h up to 12 h. VAS score more than 4 was considered as equal to 1000 mg paracetamol given intravenously every 6 h. Complications during the surgery such as intraoperative bleeding, pain on injection, nausea and vomiting, bradycardia (heart rate <50 beats/min), hypotension (fall in BP more than 20% of the baseline), and hypoxemia (fall in oxygen saturation <90%) were monitored. Bradycardia was treated with intravenous atropine sulfate 0.3 mg atropine. Hypotension was treated with ephedrine sulfate 10 mg intravenous and intravenous infusion of lactated Ringer solution. Pain during the surgery was monitored with Ramsay sedation score measured quarter hourly during surgery, then every 2 h for 12 h after completion of surgery [10]. Patients' subjective satisfaction was evaluated 12 h postoperatively using a scale with four points by asking the patients to give a score of their satisfaction regarding post-operative analgesia.

Statistical analysis

The data collected in the study was statistically analyzed using the arithmetic mean, standard deviation, the unpaired student t-test, Mann–Whitney test, and Fisher's exact test when appropriate. $p<0.05$ was considered significant. All tests were done using the Statistical Package for the Social Sciences (SPSS) version 16.0; SPSS Inc., Chicago, Illinois, USA.

RESULTS

In the present study, 64 patients were included and divided into two groups. Group A was the control group and Group B was the study group. Each group consisted of 32 patients undergoing external DCR surgery. All the surgical features related to the lacrimal sac were identical in both groups. No statistical significant complications or side effects were noted during the study such as nausea, vomiting, soreness at the site of local injection, hypotension, and/or bradycardia ($p>0.5$). The blood loss during the surgery was also similar and not accounting to grave blood loss in both groups (Table 1).

After the infiltration of local anesthetic in Group A, the time taken for the onset of anesthesia was longer than the time taken for the Group B patients. The duration of anesthesia in Group A was found much longer than the in Group A (p-value was 0.015 and 0.0001, respectively). The VAS score of the analgesia during the post-operative period was much lower (0–3) in the study Group B than in the Group A patients (4 and 5). These values were recorded after 6^{th} and 9^{th} h postoperatively with p-values at 0.002 and 0.031, respectively (Table 2). However, between the 1^{st} h and 6^{th} h, the VAS scores did not have a significant difference in analgesia. The p-values were more than 0.05 (Table 2). The Ramsay sedation score showed significant good sedation levels in Group B (study group) than the control group starting from 30 min intraoperative stage to 8 h postoperatively ($p<0.05$).

The subjective patient response in terms of sensory block, intraoperative analgesia in both groups was studied and the responses were recorded. The intraoperative analgesia in the Group B was better achieved than the analgesia in the Group A (control group); the p-value was 0.018 which was <0.05.

DISCUSSION

Although the mechanism of action and the role of dexmedetomidine in producing analgesia in the post-operative period are not yet completely understood, it was presumed to be by both central and peripheral action [11]. Dexmedetomidine acts centrally at the dorsal root neuron of the spinal cord by the release of substance "p" and inhibition at the nociceptive pathway. It also acts by the stimulation of the α-2 adrenergic receptors at the locus coeruleus [12]. By acting peripherally, dexmedetomidine reduces the nor-epinephrine release at the peripheral nerve endings by stimulating the peripheral α-2 adrenergic receptors which results in the abolishment of the nerve fiber action potential [13]. Dexmedetomidine was used in this study as a single dose of 20 μg but the range of its dose was 20–100 μg [12]. It was used by

Table 1: Demographic data and side effects following the infiltration anesthesia (n=64)

Observation	Control group (n=32) (n [%])	Dexmedetomidine group (n=35) (n [%])	p-value
Age (years)	49.23±4.58	48.02±5.32	0.23
Sex			
Male	14 (21.87)	13 (20.31)	0. 811
Female	18 (28.12)	19 (29.68)	
American Society of Anesthesiologists class			
Class I	26 (40.62)	20 (31.25)	0.715
Class II	06 (09.37)	15 (23.43)	
Duration of surgery (min)	41.42±3.50	43.02±6.28	0.510
Complications			
Pain on injection	5 (20.00)	6 (25.71)	0.415
Nausea and vomiting	6 (13.33)	4 (20.00)	0.281
Hypotension	4 (5.71)	8 (11.43)	0.318
Bradycardia	8 (20.00)	9 (28.57)	0.341
Hypoxemia	0	0	–
Blood loss (mL)	39.5±6.12	38.25±4.20	0.371

Table 2: Onset of sensory block, duration of sensory block, and the analgesia duration in the study (n=64)

Observation	Control group-A; (n=32)	Dexmedetomidine group- B; (n=32)	p-value
Onset of sensory block (min)	2.15±1.15	1.85±2.41	0.015*
Duration of sensory block (min)	162.10±14.32	199.05±32	0.0001*
Visual analog score			
Immediately post-operative	0 (0–2)	1 (0–2)	0.433
1 h	4 (1–4)	4 (0–4)	0.314
2 h	4 (1–7)	4 (1–6)	0.502
4 h	3 (2–6)	4 (1–6)	0.124
6 h	3 (2–6)	3 (1–4)	0.002*
8 h	3 (1–5)	2 (1–4)	0.031
10 h	3 (0–3)	2 (0–4)	0.421
12 h	4 (0–4)	1 (0–3)	0.324

general surgeons in brachial plexus block or any loco-regional blocks [14,15]. The studies conducted by Wu *et al*., Abdallah Brull, and Wang D *et al*. support the clinical parameters observed in this study as they were found to be similar [11,16,17]. But few studies on the contrary reported that there was no additional benefit in terms of sensory block duration when dexmedetomidine was used as an adjuvant to local anesthetic and also commented that it delays the onset of sensory block, although it improved the post-operative analgesia [18,19] The subjective patient response in terms of sensory block, intraoperative analgesia in both the groups was studied and the responses were recorded in this study. The intra-operative analgesia in Group B was better achieved than the analgesia in the Group A (control group); the p-value was 0.018 which was <0.05. Ghali *et al*. [20] also studied on the role of dexmedetomidine in sub-tenon block in vitreoretinal surgeries and reported that the motor and sensory block durations were longer when compared to levobupivacaine alone. It also showed promising higher levels of sedation intraoperatively as well as after 12 h duration postoperatively. Yousef *et al*. [21] in their study combined dexmedetomidine spinal epidural anesthesia. Mohta *et al*. [22] used it in paravertebral block and Vorobeichik *et al*. [23] in brachial plexus nerve blocks. All the above authors reported longer durations of analgesia, better sensory block, and early development of the blocks.

CONCLUSION

Dexmedetomidine added to the local anesthetic agents, acts as an adjuvant to produce an early sensory block, extended nerve block time, and post-operative analgesia without side effects and complications. Extended post-operative analgesia was associated with increased intraoperative sedation. Subjective satisfaction of the patients was achieved without side effects.

REFERENCES

1. Ciftci F, Pocan S, Karadayi K, Gulecek O. Local versus general anesthesia for external dacryocystorhinostomy in young patients. Ophthalmic Plast Reconstr Surg. 2005;21:201-6.
2. Maheshwari R. Single-prick infiltration anesthesia for external dacryocystorhinostomy. Orbit. 2008;27:79-82.
3. Jonas JB, Budde WM, Dinkel M, Hemmerling TM. Indwelling temporary retrobulbar catheter for long-lasting titratable local anesthesia. Arch Ophthalmol. 2000;118:996-1000.
4. Caesar RH, McNab AA. External dacryocystorhinostomy and local anesthesia: Technique To measure minimized blood loss. Ophthalmic Plast Reconstr Surg. 2004;20:57-9.
5. Newsom R, Wainwright A, Canning C. Local anaesthesia for 1221 vitreoretinal procedures. Br J Ophthalmol. 2001;85:225-7.
6. Kristin N, Schönfeld CL, Bechmann M, Bengisu M, Ludwig K, Scheider A, *et al*. Vitreoretinal surgery: Pre-emptive analgesia. Br J Ophthalmol. 2001;85:1328-31.
7. Stein C, Lang LJ. Peripheral mechanisms of opioid analgesia. Curr Opin Pharmacol. 2009;9:3-8.
8. Panzer O, Moitra V, Sladen RN. Pharmacology of sedative-analgesic agents: Dexmedetomidine, remifentanil, ketamine, volatile anesthetics, and the role of peripheral mu antagonists. Anesthesiol Clin. 2011;29:587-605, vii.
9. Al-Ghanem SM, Massad IM, Al-Mustafa MM, Al-Zaben KR, Qudaisat IY, Qatawneh AM, *et al*. Effect of adding dexmedetomidine versus fentanyl to intrathecal bupivacaine on spinal block characteristics in gynecological procedures: A double blind controlled study. Am J Appl Sci. 2009;6:882-7.
10. Ramsay MA, Savege TM, Simpson BR, Goodwin R. Controlled sedation with alphaxalone-alphadolone. Br Med J. 1974;2:656-9.
11. Abdallah FW, Brull RJ. Facilitatory effects of perineural dexmedetomidine on neuraxial and peripheral nerve block: A systematic review and meta-analysis. Br J Anaesth. 2013;110:915-25.
12. Biswas S, Das RK, Mukherjee G, Ghose TJ. Dexmedetomidine an adjuvant to levobupivacaine in supraclavicular brachial plexus block: A randomized double blind prospective study. Ethiop J Health Sci. 2014;24:203-8.
13. Yoshitomi T, Kohjitani A, Maeda S, Higuchi H, Shimada M, Miyawaki T. Dexmedetomidine enhances the local anesthetic action of lidocaine via an alpha-2A adrenoceptor. Anesth Analg. 2008;107:96-101.
14. Brummett CM, Norat MA, Palmisano JM, Lydic R. Perineural administration of dexmedetomidine in combination with bupivacaine enhances sensory and motor blockade in sciatic nerve block without inducing neurotoxicity in rat. Anesthesiology. 2008;109:502-11.
15. Zhang H, Zhou F, Li C, Kong M, Liu H, Zhang P, *et al*. Molecular mechanisms underlying the analgesic property of intrathecal dexmedetomidine and its neurotoxicity evaluation: An *in vivo* and *in vitro* experimental study. PLoS One. 2013;8:e55556.
16. Wu HH, Wang HT, Jin JJ, Cui GB, Zhou KC, Chen Y, *et al*. Does dexmedetomidine as a neuraxial adjuvant facilitate better anesthesia and analgesia? A systematic review and meta-analysis. PLoS One. 2014;9:e93114.
17. Zhang X, Wang D, Shi M, Luo YJ. Efficacy and safety of dexmedetomidine as an adjuvant in epidural analgesia and anesthesia: A systematic review and meta-analysis of randomized controlled trials. Clin Drug Investig. 2017;37:343-54.
18. Gandhi R, Shah A, Patel I. Use of dexmedetomidine along with bupivacaine for brachial plexus block. Natl J Med Res. 2012;2:67-9.
19. Hurwitz JJ, Mishkin S. Bilateral simultaneous dacryocystorhinostomy. Ophthalmic Plast Reconstr Surg. 1989;5:186-8.
20. Ghali AM, Shabana AM, El Btarny AM. The effect of low-dose dexmedetomidine as an adjuvant to levobupivacaine in patients undergoing vitreoretinal surgery under sub-tenon's block anesthesia. Anesth Analg. 2015;121:1378-82.
21. Yousef AA, Salem HA, Moustafa MZ. Effect of mini-dose epidural dexmedetomidine in elective cesarean section using combined spinal-epidural anesthesia: A randomized double-blinded controlled study. J Anesth. 2015;29:708-14.
22. Mohta M, Kalra B, Sethi AK, Kaur NJ. Efficacy of dexmedetomidine as an adjuvant in paravertebral block in breast cancer surgery. J Anesth. 2016;30:252-60.
23. Vorobeichik L, Brull R, Abdallah FW. Evidence basis for using perineural dexmedetomidine to enhance the quality of brachial plexus nerve blocks: A systematic review and meta-analysis of randomized controlled trials. Br J Anaesth. 2017;118:167-81.