Archives of Anesthesiology and Critical Care (Winter 2021); 7(1): 38-43.

Available online at http://aacc.tums.ac.ir

Research Article

Comparison of Dexamethasone Composition with Bupivacaine and Dexmedetomidine with Bupivacaine and Bupivacaine Alone in a Supraclavicular Block with Low Volume

Mohammadreza Moshari, Behnam Hosseini*, Seyed Mohammad Seyed Alshohadaei, Fereshteh Baghizadeh

Anesthesiology Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

ARTICLE INFO

Article history:
Received 23 December 2020
Revised 15 January 2021
Accepted 29 January 2021

Keywords:
Bupivacaine;
Dexamethasone;
Dexmedetomidine;
Supraclavicular block

ABSTRACT

Background: Regional blocks is a good alternative to general anesthesia in upper extremity surgeries. Supraclavicular is a kind of regional block which can be used to treat nerve block in the upper extremity. The ancillary drugs are nowadays used to enhance the quality and quantity of sensory and motor block. The present study has attempted to investigate the effect of three prescription drugs (composition Dexamethasone with Bupivacaine and Dexmedetomidine with Bupivacaine and Bupivacaine alone) on supraclavicular block.

Methods: This parallel Design study was conducted in 2017 as a clinical trial at Ayatollah Taleghani Hospital in Tehran. For this purpose, 60 patients over the age of 18 and in class I, II of the American Anesthesiology Association (ASA) who were candidates for upper limb elective surgery, were enrolled. Patients included in the study (60 patients) were randomly divided into three equal groups (n= 20). Anesthesia procedure was performed for all patients in three equal groups. However, to evaluate the efficacy of selected drugs, different drugs were injected into each group. After completing the design and recording the results of the variables under study, the t-test was used to compare quantitative variables between the two groups. All statistical tests were performed in two domains (5% significance level) and SPSS 21 software was used for data analysis.

Results: In the levels of intraoperative factors in the comparative conditions of the BB[1] with BDexa[2] and BB with BDex[3] groups. However, Duration of Sensory Block (P=0.004) and Duration of Movement Block (P=0.001) were significantly different in BD and BDex groups.

Conclusion: What can be clearly seen in the results are the significant changes of Duration of Sensory Block and Duration of Movement Block compared to the BDexa and BDex groups. Based on these results, in both cases we find a significant decrease in the measured duration in the BDexa group compared to the opposite group.

Use of Bupivacaine + Dexamethasone has a more positive effect on Supraclavicular block compared to Bupivacaine + Dexmedetomidine and Bupivacaine alone.

Due to the increasing spread of science in recent years, all areas of medicine have also undergone tremendous developments. Innovative approaches to disease diagnosis and treatment have been a constant challenge for medical teams. Anesthesia is also an integral part of all types of surgery, which is expanding to create new conditions to reduce risks and improve patient conditions. Modern methods of anesthesia strive

The authors declare no conflicts of interest.

*Corresponding author.
E-mail address: dr_b_hosseini@sbmu.ac.ir

to provide targeted and accurate use of new drugs while maintaining the right conditions for surgery.

Today, the use of regional blocks is a good alternative to general anesthesia in upper extremity surgeries [1]. In this way, the brain function of the elderly patients is preserved and we protect the patient from pharyngeal manipulation, impulse aspiration and intubation stress [3]. Axillary and supraclavicular block can be used to treat nerve block in the upper extremity. The advantages of the supraclavicular axillary block include convenience, availability, reliability, and a higher percentage of success in anesthesia. In addition, less damage to the axillary and musculocutaneous nerves [2]. However, the method also has problems including shortening the effect of sensory and neural block during surgery and having no effect on the administration of postoperative analgesia (continued postoperative analgesic effects) [2]. Therefore, the use of ancillary drugs is nowadays used to enhance the quality and quantity of sensory and motor block without increasing or imposing side effects. Various compounds have been used as adjuvants along with anesthetics; among them, we can refer to Midazolam [4], Neostigmine [4], Bicarbonate [4], opioids [5-6], Alpha-2 Agonists [7] and Hyaluronidase [4].

The use of corticosteroids with the mechanism of reducing inflammation, blocking nociceptive c-fibers and suppressing the electrical activity of the nerves, not only during the operation but also after the operation will provide a good quality of analgesia and patients will have longer analgesia after surgery [8-10]. Therefore, the use of these drugs is common in many surgical procedures and anesthetics.

Bupivacaine is an amino acid that acts on voltage-dependent sodium channels and induces anesthesia in peripheral afferents [11]. It has fewer toxic effects than other environmental anesthetics [12]. The drug also passes through myelinated motor fibers for a longer period of time due to lower lipophilic levels than other amides. For this reason, the function duration of this drug that blocks the motor nerve is longer than other amide drugs [13]. This reduction in the harmful effects of ropivacaine has led to a growing popularity in its use.

Dexmedetomidine is a specific and potent α2-adrenergic agonist (8 times more selective than clonidine) [14]. It has sedative, analgesic, antihypertensive and anesthetic effects if used systemically [15]. Combining this drug with other topical and regional anesthetic agents improves the quality of anesthesia and improves patient and physician satisfaction [16]. Many studies have shown that this drug increases the duration of the block and reduces the need for analgesics after surgery [17-18]. It is sufficient that the present drug is a choice in many surgeries.

In light of all the aforementioned cases, the present study has attempted to investigate the effect of three prescription drugs (composition Dexamethasone with Bupivacaine and Dexmedetomidine with Bupivacaine and Bupivacaine alone) on supraclavicular block.

Methods

Population surveyed and samples

This parallel Design study was conducted in 2017 as a clinical trial at Akhtar Hospital in Tehran. For this purpose, 60 patients over the age of 18 and in class I, II of the American Anesthesiology Association (ASA) who were candidates for upper limb elective surgery, were enrolled. To reduce possible errors, people with a history of cardiovascular disease, shortness of breath, diabetes, kidney or liver disease or a history of taking narcotic, alcohol and antiepileptic, psychotic and patients who have severe pain during surgery (who had to undergo general anesthesia) were excluded from the study. Patients included in the study (60 patients) were randomly divided into three equal groups (n= 20). The following formula was used to calculate the sample size:

$$n \geq \frac{2\left(z_{\alpha} + z_{\beta}\right)^{2}\sigma^{2}}{\left(\mu_{1} - \mu_{2}\right)^{2}}$$

Probability of type one error: $\alpha = 0.05 \Rightarrow z_{\alpha} = 1.96$

Test exponent: $1 - \beta = 0.90 \Rightarrow z_{\beta} = 1.28$

Mean Dexamethasone and Bupivacaine: $\mu_{1} - \mu_{2}$

Standard deviation of dexamethasone with Bupivacaine: σ

Sample size for research:

$$n \geq 2\left(1.96 + 1.28\right)^{2}\left(\frac{1}{0.60}\right)^{2} = 60$$

Research Methods

After the patients were admitted to the operating room, standard cardiac monitoring (ECG), non-invasive blood pressure (NIBP) and pulse oximeter (SPO2) were installed and then 5 ml / kg of Ringer was administered. After measuring HR, BP and SPO2 (as baseline), block start time, block duration, and surgeon physician satisfaction were recorded. VAS was measured at 12 and 24 hours after surgery. Patients' pain (based on VAS) was measured at 12 and 24 hours postoperatively. Also, intraoperative analgesia was calculated according to RAMSAY SEDATION SCORE criteria. Sensory and motor block quality was assessed according to the Bromage Scoreboard (4 points) and pin prick method for sensory block.

Anesthesia procedure was performed for all patients in three equal groups. However, to evaluate the efficacy of selected drugs, the following method was used:

- Group 1: BDexa group 20 cc of Bupivacaine (0.5%)+ 1 µg Dexamethasone + 1 cc Normal saline was injected.

• Group2: BDex group 20 cc of Bupivacaine (0.5%)+ 8 mg dexmedetomidine was injected.

• Group 3: BB group received 20 cc of Bupivacaine (0.5%) + 2cc Normal saline was injected.

Statistical analysis method

After completing the design and recording the results of the variables under study, the normality of the quantitative variables was assessed by Kolmogorov-Smirnov test and box diagrams and normal probability. The t-test was used to compare quantitative variables between the two groups. Chi-square test and Fisher's exact test were used to compare the qualitative variables. All statistical tests were performed in two domains (5% significance level) and SPSS 21 software was used for data analysis.

Results

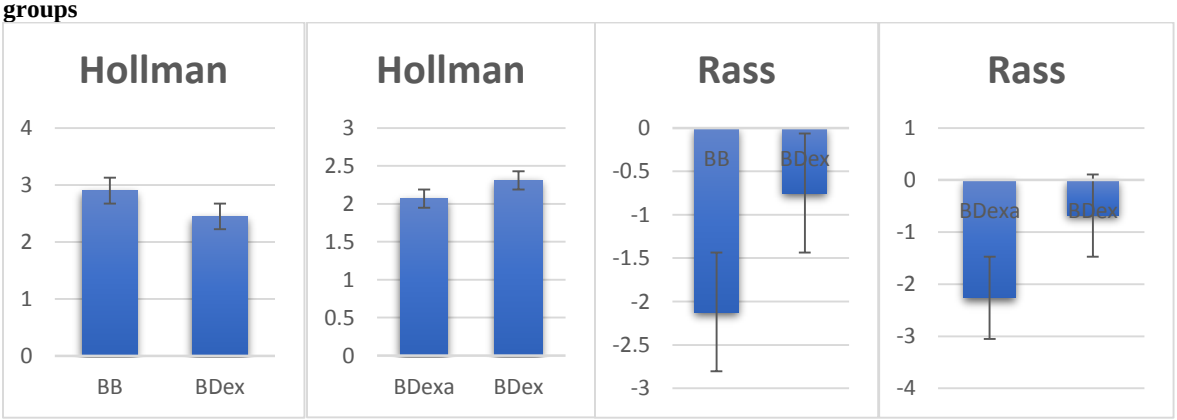
In this study, which was conducted on 60 patients over 18 years old and candidates for upper limb elective surgery in Tehran's Akhtar Hospital, 40 patients (66.7%) were male and 20(33.3%) were female. The mean age of patients included in the study was approximately 39 years.

Based on the results of this study "Comparison of Dexamethasone composition with Bupivacaine and Dexmedetomidine with Bupivacaine and Bupivacaine alone in a supraclavicular block with low volume", internationally agreed scoring indices were compared in three groups. Therefore, the most significant differences were observed between the BDexa and BDex groups. As can be seen in (Table 1), these changes in the Hollman (p= 0.043) and Rass (p= 0.002) indices show significant differences. These indices were significantly different between the two groups of BB and BDex in only two cases of Hollman (P= 0.050) and Rass (P=0.007). However, no significant changes were observed in the BB and BDexa groups (Figure 1).

Table 1- Comparison of international scoring indices in the three study groups

		ASA (M± SD)	Ramsay (M± SD)	Rass (M± SD)	VAS (M± SD)	Likert (M± SD)	Hollman (M± SD)	Bromage (M± SD)
1	BB	1.3±0.0	1.5±1.8	-2.01±1.01	1.87±1.48	3.7±0.38	2.9±0.32	1.51±0.68
	BDexa	1.18±0.48	2.2±2.1	-2.26±1.28	0.86±0.35	3.87±0.34	2.87±0.34	1.34±0.29
	P value	0.176	0.328	0.842	0.953	0.100	0.851	0.765
2	BB	1.0±0.0	1.4±2.41	-2.12±1.15	1.87±1.48	3.5±0.53	2.9±0.32	1.22±0.71
	BDex	1.21±0.41	1.40±0.81	-0.75±1.10	0.81±0.40	3.15±0.36	2.45±0.52	1.52±0.35
	P value	0.281	0.765	0.007*	0.81	0.265	0.050*	0.811
3	BDexa	1.45±0.61	2.4±1.90	-2.26±1.01	0.76±0.32	3.08±0.21	2.07±0.41	1.12±0.50
	BDex	1.24±0.41	1.45±0.94	-0.68±1.10	0.74±0.21	3.11±0.41	2.31±0.48	1.82±0.47
	P value	0.405	0.321	0.002*	0.547	0.401	0.043*	0.409

Figure 1- Comparative graph of two international scoring indices (Hollman and Rass) in the two R and BDex groups



As can be seen in (Table 2), three of the vital signs of patients (HR, MAP and SPO2) were measured at three-time intervals before sedation, 5 and 10 minutes after sedation. According to the results in this table, the level of SPO2 was the most significant among the three groups of patients compared to the other two critical factors (at all three intervals).

Table 2- Comparison of the vital factors of the patients studied at three different times.

		Vital signs sedation			Vital signs 5 minute after sedation			Vital signs 10 minute after sedation		
		SPO2 (M± SD)	MAP (M± SD)	HR (M± SD)	SPO2 (M± SD)	MAP (M± SD)	HR (M± SD)	SPO2 (M± SD)	MAP (M± SD)	HR (M± SD)
1	BB	84.8±2.23	89.1±14.11	79.7±15.25	97.8±2.04	83.2±9.39	74.9±13.95	97.5±1.94	83.8±9.31	71.2±14.98
	BDexa	85.2±2.14	83.7±17.56	84.3±11.04	95.6±4.49	81.4±13.58	83.5±11.20	95.5±4.44	81.0±13.65	83.1±11.21
	P value	0.006*	0.501	0.419	0.107	0.699	0.116	0.124	0.537	0.043*
2	BB	94.8±2.15	89.1±14.11	79.7±15.25	97.8±2.04	83.2±9.39	74.9±13.95	97.5±1.94	83.8±9.31	71.2±14.98
	BDex	94.8±2.27	79.8±15.85	76.0±14.40	95.8±1.94	84.3±17.87	75.9±12.28	97.4±2.25	85.1±16.48	75.6±16.62
	P value	0.985	0.172	0.575	0.039*	0.853	0.863	0.915	0.828	0.541
3	BDexa	97.2±2.05	83.7±17.56	84.3±11.04	95.6±4.49	81.4±13.58	83.5±11.20	95.5±4.44	81.0±13.65	83.1±11.21
	BDex	94.8±94.8	79.8±15.85	76.0±14.40	95.8±1.94	84.3±17.87	75.9±12.28	97.4±2.25	85.1±16.48	75.6±16.62
	P value	0.009*	0.551	0.124	0.880	0.651	0.115	0.147	0.496	0.207

* Significant differences

Accordingly, the comparative value of this factor was significantly different between the BB and BDexa (P= 0.006) groups as well as BDexa and BDex (P= 0.009) in the pre-sedation period. However, this factor (SPO2) at 5 min after sedation showed a significant difference between the BB and BDex (P= 0.039) groups on the other hand, the HR factor also showed a significant difference between the BB and BDexa (P= 0.043) groups at 10 minutes post-sedation (Figure 2).

Figure 2- Comparative chart of some of the vital indicators of the patients under study with significant changes

The results in Table 3 indicate no major changes in the levels of intraoperative factors in the comparative conditions of the BB with BDexa and BB with BDex groups. However, Duration of Sensory Block and Duration of Movement Block were significantly different in BDexa and BDex groups (Table 3).

Table 3- Comparison of patient's surgical indices

		Sensory Block Start Time (Min) (M± SD)	Movement block Start Time (min) (M± SD)	Duration of sensory Block (hours) (M± SD)	Duration of Movement Block (hours) (M± SD)	Nausea (M± SD)
1	BB	12.8±7.42	16.4±14.52	4.9±3.98	5.2±3.14	0.25±0.71
	BDexa	12.3±5.72	19±9.94	4.54±1.11	5.4±1.34	0.0±0.00
	P value	0.861	0.626	0.817	0.797	0.0
	BB	12.8±7.42	16.4±14.52	4.9±3.98	5.2±3.14	0.25±0.71

2	BDex	12.8±8.39	15.0±6.71	5.9±1.07	7.3±1.12	0.50±0.60
	P value	0.995	0.691	0.518	0.108	0.829
	BDexa	12.3±5.72	19.0±9.94	4.5±1.11	5.4±1.34	0.0±0.00
3	BDex	12.8±8.39	15.0±6.71	5.9±1.07	7.3±1.12	0.50±0.60
	P value	0.864	0.223	0.004*	0.001*	0.341

Discussion

One of the major challenges in all types of surgery is finding a way to reduce the risks during and after surgery. These possible ways are sometimes associated with the invention of new methods in patient management and the surgical process and sometimes with the introduction of new drugs. Research published by various researchers around the world indicates their approach to optimizing medication use in order to access the best possible treatment or reduce the risk. In this study also presented as "Comparison of Dexamethasone Composition with Bupivacaine and Dexmedetomidine with Bupivacaine and Bupivacaine alone in a Supraclavicular Block with Low Volume", the effect of three drugs Dexamethasone, Dexmedetomidine and Bupivacaine, under the conditions specified for Supraclavicular was investigated. Based on the results, although in some cases there are significant changes in the groups evaluated, yet most of the factors studied do not show specific conditions. What can be clearly seen in the results are the significant changes of Duration of Sensory Block and Duration of Movement Block compared to the BDexa and BDex groups. Based on these results, in both cases we find a significant decrease in the measured duration in the BDexa group compared to the opposite group. This in itself can be a relative advantage for the concomitant use of Bupivacaine and Dexamethasone. These results are important because numerous studies in the past have emphasized the importance and quality of Dexmedetomidine as a relatively newer drug.

Conclusion

The results indicate that concomitant use of Bupivacaine + Dexamethasone has a more positive effect on Supraclavicular block compared to Bupivacaine+ dexmedetomidine and Bupivacaine alone.

References

[1] McCartney CJ, Brull R, Chan VW, Katz J, Abbas S, Graham B, Nova H, Rawson R, Anastakis DJ, von Schroeder H. Early but no long-term benefit of regional compared with general anesthesia for ambulatory hand surgery. Anesthesiology. 2004; 101(2):461-7.

[2] Khanduri KC. Regional Anaesthesia Techniques for Orthopaedic Surgery. Med J Armed Forces India. 20080; 64(2):108-10.

[3] Klein SM, Evans H, Nielsen KC, Tucker MS, Warner DS, Steele SM. Peripheral nerve block techniques for ambulatory surgery. Anesth Analg. 2005; 101(6):1663-76.

[4] Damien B, Murhy CJ, Carteny VW. Novel analgesic adjuvants for brachial plexus block: A systemic review. Anesth Analg. 2000; 90:1122-8.

[5] Karakaya D, Büyükgöz F, Barş S, Güldoğuş F, Tür A. Addition of fentanyl to bupivacaine prolongs anesthesia and analgesia in axillary brachial plexus block. Reg Anesth Pain Med. 2001; 26(5):434-8.

[6] Reuben SS, Reuben JP. Brachial plexus anesthesia with verapamil and/or morphine. Anesth Analg. 2000; 91(2):379-83.

[7] Eledjam JJ, Deschodt J, Viel EJ, Lubrano JF, Charavel P, d'Athis F, du Cailar J. Brachial plexus block with bupivacaine: effects of added alpha-adrenergic agonists: comparison between clonidine and epinephrine. Can J Anaesth. 1991; 38(7):870-5.

[8] Golwala MP, Swadia VN, Dhimar AA, Sridhar NV. Pain relief by dexamethasone as an adjuvant to local anaesthetics in supraclavicular brachial plexus block. J Anaesth Clin Pharmacol. 2009; 25(3):285-8.

[9] Cummings III KC, Napierkowski DE, Parra-Sanchez I, Kurz A, Dalton JE, Brems JJ, Sessler DI. Effect of dexamethasone on the duration of interscalene nerve blocks with ropivacaine or bupivacaine. Br J Anaesth. 2011; 107(3):446-53.

[10] Dar FA, Najar MR, Jan N. Effect of addition of dexamethasone to ropivacaine in supraclavicular brachial plexus block. Indian Journal of Pain. 2013; 27(3):165.

[11] Vainionpaa VA, Haavisto ET, Huha TM, Korpi KJ, Nuutinen LS, Hollmen AI, Jozwiak HM, Magnusson AA. A clinical and pharmacokinetic comparison of ropivacaine and bupivacaine in axillary plexus block. Anesth Analg. 1995; 81(3):534-8.

[12] Scott DB, Lee A, Fagan D, Bowler GM, Bloomfield P, Lundh R. Acute toxicity of ropivacaine compared with that of bupivacaine. Anesth Analg. 1989; 69(5):563-9.

[13] Arthur GR, Feldman HS, Covino BG. Comparative pharmacokinetics of bupivacaine and ropivacaine, a new amide local anesthetic. Anesth Analg. 1988; 67(11):1053-8.

[14] Gerlach AT, Dasta JF. Dexmedetomidine: an updated review. Ann Pharmacother. 2007; 41(2):245-54.

[15] Kettner SC. Dexmedetomidine as adjuvant for peripheral nerve blocks. Br J Anaesth. 2013; 111(1):123.

[16] Ammar AS, Mahmoud KM. Ultrasound-guided

single injection infraclavicular brachial plexus block using bupivacaine alone or combined with dexmedetomidine for pain control in upper limb surgery: A prospective randomized controlled trial. Saudi J Anaesth. 2012; 6(2):109-14.

[17] Esmaoglu A, Yegenoglu F, Akin A, Turk CY. Dexmedetomidine added to levobupivacaine prolongs axillary brachial plexus block. Anesth Analg. 2010;111(6):1548-51.

[18] Obayah GM, Refaie A, Aboushanab O, Ibraheem N, Abdelazees M. Addition of dexmedetomidine to bupivacaine for greater palatine nerve block prolongs postoperative analgesia after cleft palate repair. Eur J Anaesthesiol. 2010; 27(3):280-4.

[1] Bupivacaine

[2] Bupivacaine + Dexamethasone

[3] Bupivacaine + Dexmedetomidine