Journal of Applied Pharmaceutical Research
Volume 10 Issue 4, Year of Publication 2022, Page 14 – 18
DOI: 10.18231/j.joapr.2022.10.4.14.18

Check for updates

Research Article

JOURNAL OF APPLIED PHARMACEUTICAL RESEARCH | *JOAPR*
www.japtronline.com *ISSN: 2348 – 0335*

CLINICAL COMPARISON OF ANALGESIC EFFICACY OF ADDITION OF INJECTION DEXAMETHASONE 8MG TO 20ML 0.5% LEVOBUPIVACAINE IN ULTRASONOGRAPHY ASSISTED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

Chetali Das*, Rajni Mathur, Srishti Kukreja

Article Information
Received: 4th March 2022
Revised: 30th September 2022
Accepted: 13th October 2022
Published: 31st December 2022

Keywords
Levobupivacaine, dexamethasone, ultrasonography, supraclavicular block, low volume

ABSTRACT

Background: Ultrasonography-assisted supraclavicular block is an efficacious and practical method and allows us to use a lower volume of local anesthetic in compactly arranged brachial plexus. The study envisioned evaluating the analgesic and anesthetic effects of Inj. dexamethasone (8mg) as an adjuvant to 0.5% levobupivacaine to determine the time for first rescue analgesia and number of rescue analgesics needed in 24 hours duration in brachial plexus blockade in adult patients listed for upper limb surgeries. **Results:** This prospective randomized double-blind interventional study was carried out in ASAI and II, aged 20 to 55 years. In group A (n=30) Inj. Levobupivacaine 20ml and Inj. Normal saline 2ml was given. In group B (n=30) Inj. Levobupivacaine 20ml and Inj. Dexamethasone 2ml was given. The time for the demand of the first rescue analgesia was 431.50 ± 46.15 minutes in group A and 749.38 ± 62.41 minutes in group B, with a p-value < 0.001. The demand for rescue analgesics was more in Group A in contrast to Group B. **Conclusion:** We deduce with our study, with the addition of dexamethasone, the time for rescue analgesia is prolonged, and the number of rescue analgesic demands is reduced, with a faster onset and extended duration of both sensory and motor block.

INTRODUCTION

Brachial plexus block is often practiced regional anesthetic approach for surgical anesthesia of upper extremity surgeries. It prevents undesirable problems of general anesthesia and upper airway instrumentation [1]. Relatively less requirement of the anesthetic solution with a rapid onset of action is seen in the supraclavicular block because of its compact arrangement [2,3]. High-frequency ultrasound probes help in accurately localizing the nerve. Brachial plexus, blood vessels, needle placement, and local anesthetic spread are visualized in real-time. Use of ultrasonography, now a routine, wherein a low volume of local

*Department of Anaesthesiology and Critical Care, S.M.S. Medical College and Attached Group of Hospitals, Sawai Mansingh road, Jaipur, 302004, India

***For Correspondence:** **chetalidas@gmail.com**

anesthetic is used thus avoiding side effects including paralysis of the diaphragm, hoarseness, and Horner syndrome [4].

Levobupivacaine, a pure S-enantiomer of bupivacaine, was used in the study, as only a handful of studies are conducted with levobupivacaine. A potent glucocorticoid, dexamethasone with anti-inflammatory and immunosuppressant action used as an adjuvant for denser block and faster onset [5,6]. The study was directed to ascertain the time of need for the first rescue analgesia and the number of rescue analgesics demanded in 24 hrs [6,7].

MATERIALS AND METHODS

The present study was carried out in a tertiary care institute after obtaining permission from the ethics committee and review board and a written consent form from the patient was obtained. The study was performed after due registration in CTRI (CTRI/2020/09/02776).

It was a prospective, randomized, interventional study wherein subjects were allocated in 2 groups of 30 pts each (N=60) by sealed enveloped method. Patients of ASA Class I and II, scheduled for surgeries of the forearm and hand, of either sex, age group 20-55 years with a duration of surgery of 1-4 hours were included.

Patients who refused to give consent for the study, uncooperative patients, injection site infection, history of study drugs allergy, coagulopathies, contra lateral diaphragmatic paralysis, or any other neuropathies, systemic use of corticosteroids for 2 weeks or longer within 6 months of surgery were excluded. The block procedures with likely complications were explained to the patients in the pre-anesthetic checkup.

In the operation theatre, baseline vital parameters, heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial blood pressure (MAP), and oxygen saturation (SpO_2) were recorded. Intravenous access was secured and infusion of intravenous fluid was started. The supraclavicular block was done using an ultrasound machine (Sonosite MicroMaxx L38e/10-5 MHz, WA 98021 USA). The patient's head was turned to the opposite side at approx. 30^o in the supine position. Under all aseptic precautions, the block was performed with a high frequency [8-13MHz] linear probe which was placed in the supraclavicular fossa, and the alignment marker was checked. All the blocks were conducted by a single operator anesthesiologist experienced in performing more than 50 successful blocks.

The subclavian artery and brachial plexus were identified in their short axis. The plexus appeared as several hypoechoic circles cephalo-posterior to the pulsatile artery[8]. Using the out-plane technique, a 20-gauge cannula stylet was used to perform the block which typically contacts the rib at a depth of 3 to 4 cm.

Accidental intravascular needle puncture is avoided after repeated negative aspiration of injecting the drug. 20ml 0.5% levobupivacaine with 2mL normal saline was given to Group A and 20ml 0.5% levobupivacaine with 2 mL Dexamethasone (8 mg) was given to Group B. Intravenous midazolam 0.05 mg/kg given after the block.

Sensory blockade was assessed by the pinprick method at each minute after completion of the block [9]**.** The assessment was done along the distribution of the median nerve, radial nerve, ulnar nerve, and musculocutaneous nerve. Motor block was assessed by the Lovette rating scale, done by thumb adduction (ulnar nerve), thumb abduction (radial nerve), thumb opposition (median nerve), and flexion of the elbow and pronation of the forearm (musculocutaneous nerve) [10]. The mean onset time of motor and sensory blockade was noted.

Onset of sensory block: The onset of sensory block was defined as the time interval between drug administration and the onset of Grade 1 sensory block in the hand (3 nerve distribution).
Full sensory block was defined as the complete loss of sensation to a pinprick, Grade 2.
Duration of sensory block was defined as the time interval between the complete sensory block and the return of normal sensation.
Onset of motor block: The onset of motor block was defined as the time between completion of local anesthetic injection and complete paralysis.
Duration of Motor Block: duration of motor block was defined as the time interval from complete paralysis to complete recovery of motor function.
Duration of analgesia: The time between the onset of analgesia and the first request for analgesia. Hemodynamic parameters were recorded pre-operatively before drug administration, after drug administration, and thereafter every 15 min.

Post-operative Period: The time for the first rescue analgesic, duration of analgesia, number of rescue analgesics, hemodynamic parameters, and any other complications were observed.

The assessment of pain was done using a numerical rating scale. A score of 5 or more on the scale was considered as termination of analgesic action and Injection of tramadol 100 mg intravenously was given as rescue analgesia [10].

Analysis of data:

Statistical analysis was performed with the SPSS (Statistical Package for the Social Science), version 21 for Windows statistical software package (SPSS Inc., Chicago, IL, USA). All the qualitative data were analyzed using the chi-square method and the quantitative method by unpaired t-test. Results obtained in Mean ± SD. P values < 0.05 were statistically significant and < 0.001 were taken highly significant.

RESULT & DISCUSSION

Table 1 Demographic parameters

	Group A	Group B	P value
Age (Years)	33.40±11.551	34.73±10.29	1.000 (NS)
Sex (M:F)	24:6	26:4	0.729 (NS)
ASA* (1&2)	66.66:33.34	26:4	0.784 (NS)

*ASA – American Society of Anesthesiologist

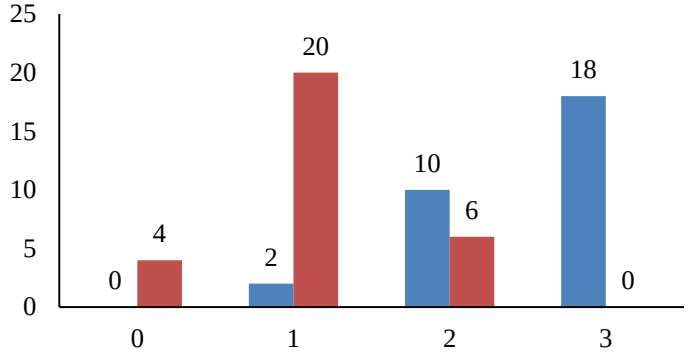

Fig 1: Total no of rescue analgesics needed in 24hrs

Table 2 Comparison of Analgesic parameters in both groups

Parameter (minutes)	Group A	Group B	Pvalue
Onset of sensory block	7.60 ± 1.63	5.80±1.21	<0.001
Onset of motor block	11.63±2.76	9.23±2.75	<0.001
Duration of sensory block	413.13±46.09	603.53±69.93	<0.001
Duration of motor block	398.03±46.40	532.63±0.58	<0.001
Time for first rescue analgesia	431.50±46.15	749.38±62.41	<0.001

As can be seen from table 1, demographic parameters of both the group were comparable.

The mean onset of sensory and motor block was earlier in Group B. The mean duration of sensory and motor block was significantly prolonged in group B compared with group A ($p<0.001$) as mentioned in table 2.

The time of the need for first dose of rescue analgesia is 431.50 ± 46.15 min in group A and 749.38 ± 62.41 min in Group, the p-value being < 0.001. Thus, the time for the need for first rescue analgesia is significantly prolonged in Group B in contrast to A (as shown in table II). The number of rescue analgesics needed in group B is reduced in contrast with Group A, the results being highly significant (FIG.1). Failed or patchy blocks were not seen. The hemodynamic parameters were comparable and none of the patients experienced side effects in either group.

Supraclavicular brachial plexus block is a great option because of the compactness of the distal trunk increasing the success rate, superior postoperative analgesia, early ambulation, and faster recovery is seen [11].

Levobupivacaine which has got a relatively longer duration of action was chosen for study. It is a levorotatory enantiomer of bupivacaine having a more cardio-stable profile with same anesthetic activity as R-dextrobupivacaine [12–14].

We reduced the volume of levobupivacaine to 20ml as we used sonography to precisely locate the brachial plexus and to study the consequence of low volume on the duration of the block. Performing supraclavicular block via paresthesia technique large volume of local anesthetic is needed which increases the success rate but might lead to complications (Horner's syndrome, phrenic nerve palsy, systemic toxicity, etc.) due to more spread of drug [15]. Therefore, using the ultrasonography technique enables us to use lower volume and adding the adjuvant increases the duration without increasing the volume and causing minimal side effects [11].

To improve block characteristics and increase the duration of analgesia postoperatively, adjuvants are added to local anesthetics in peripheral nerve blocks. There are few studies on steroids such as methyl prednisolone, dexamethasone when used as adjuvants have prolonged the duration of postoperative analgesia [10,11,15].

Steroids act intracellularly to cause nuclear transcription and reduces the requirement of the local anesthetic by causing vasoconstriction. In a study it was noticed that steroids suppress inflammatory mediator's synthesis and secretion leading to analgesia for up to 48 hours[16]. Another study showed that dexamethasone act on glucocorticoid receptors, which increases the activity of inhibitory potassium channels on nociceptive C-fibers[17]. It might help in trapping the highly ionized levobupivacaine molecule in the neuronal cells which increases the duration of analgesia [7].

No statistical difference in demographic Data was found between both groups and all patients belonged to ASA classes I and II.

We demonstrated that the addition of dexamethasone to 0.5% levobupivacaine in supraclavicular brachial plexus block delayed the need for rescue analgesia with a reduced need for a number of rescue analgesia. It helped in earlier onset of both sensory and motor block with increased duration of analgesia.
Shrestha BR et al[5] (2003), Dexamethasone 4-8mg was used as an adjuvant with Inj. lidocaine 2% with adrenaline and Inj. bupivacaine,40-50ml local anaesthetic in a study. Onset was faster and duration prolonged in the dexamethasone group.
In our study, in Group B, 4 patients did not require any rescue analgesic in 24hours postop duration, 20 patients required one dose of rescue analgesia, and the rest 6 required 2 doses of rescue analgesia within 24 hours postoperatively. Whereas in Group A, 18 patients required 3 doses of rescue analgesia, 10 required 2 doses of rescue analgesia and the rest 2 required 1 dose in 24 hours postoperative duration. Thus, group B patients had a significantly longer duration of postoperative analgesia and the requirement for additional analgesic was significantly reduced ($p < 0.001$: highly significant).

The Numerical rating score (NRS) of ≥ 5 was attained by 431.50 ± 46.15 min in Group A and by 749.38 ± 62.41 min in Group B. Thus rescue analgesia was started earlier in Group A and subsequently the number of rescue analgesics was more in Group A.

Our study was in consonance with the studies of Shrestha BR et al [5] (2003), Persec J et al [17] (2013), Hanumansetty K et al [11]in 2017, Pani N et al [15] in 2019 reported significantly prolonged duration of postoperative analgesia and decreased requirement of rescue analgesics in the first 24 hours postoperative period with dexamethasone. There are studies on dexamethasone as an adjuvant with different local anesthetic but very few with levobupivacaine which is a relatively new local anesthetic in the market.

Pani N et al [15] conducted a study in 2019 to compare the adjuvant action of 8mg dexamethasone which was added with 25ml levobupivacaine (0.5%) in Supraclavicular block reported that it prolonged postoperative analgesia and delayed the first rescue analgesic request and a number of analgesia in comparison to levobupivacaine alone which was similar to our finding.

Hanumansetty K et al [11] used 30ml of levobupivacaine (0.5%) with 8mg dexamethasone and the technique used was a peripheral nerve stimulator. The study had a comparable duration of analgesia but had no effect on the onset. In the literature, we did not find any literature with significant side effects while using 8 mg of dexamethasone as an adjuvant in brachial plexus block nor did we encounter any side effects in our study.

Our study was limited to no long term follow up. In the levobupivacaine with dexamethasone group, 4 patients did not receive rescue analgesics even at the end of 24hrs. However, self-reporting for late-onset neuropathy is possible.

CONCLUSION

We deduce from our study that, levobupivacaine 0.5% 20ml with dexamethasone (8mg) when compared to levobupivacaine 0.5% 20ml alone in supraclavicular brachial plexus block showed, reduced need for rescue analgesic and a number of rescue analgesia . Reducing the volume of levobupivacaine didn't have significant difference provided the block is performed under USG guidance.

FINANCIAL ASSISTANCE

Nil

CONFLICT OF INTEREST

The authors declare no conflict of interest

AUTHOR CONTRIBUTION

Rajni Mathur and Chetali Das planned the study, did a literature survey, designed the manuscript, and collected the data. Srishti

Kukreja did the statistical analysis. All the authors helped in proofreading and reviewing the final manuscript

REFERENCES

[1] Bruce BG, Green A, Blaine TA, Wesner LV. Brachial plexus blocks for upper extremity orthopaedic surgery. *J Am Acad Orthop Surg*, **20**, 38–47 (2012).

[2] La Grange P, Foster PA, Pretorius LK. Application of the Doppler ultrasound bloodflow detector in supraclavicular brachial plexus block. *Br J Anaesth*, **50**, 965–7 (1978).

[3] *Cousins and Bridenbaugh's Neural Blockade in Clinical Anesthesia and Pain ... - Google Books*. 4th ed.

[4] D'Souza RS, Johnson RL. Supraclavicular Block. *StatPearls*, (2022).

[5] Shrestha BR, Maharjan SK, Tabedar S. Supraclavicular brachial plexus block with and without dexamethasone - a comparative study. *Kathmandu Univ Med J (KUMJ)*, **1**, 158–60 (2003).

[6] Shrestha BR, Maharjan SK, Shrestha S, Gautam B, Thapa C, Thapa PB, Joshi MR. Comparative study between tramadol and dexamethasone as an admixture to bupivacaine in supraclavicular brachial plexus block. *JNMA J Nepal Med Assoc*, **46**, 158–64 (2007).

[7] Raj SA, Singh DR, Charles SAJ, Krishnaveni N. Efficacy of Tramadol or Dexamethasone as an Adjuvant to Levobupivacaine in Ultrasound-guided Supraclavicular Plexus Block for Upper Limb Surgery: A Randomized Double-blinded Controlled Study. *Anesth Essays Res* **11**, 567-71. (2017)

[8] Farag E, Mounir-Soliman L. *Brown's Atlas of Regional Anesthesia*. 5th edition ed., Elsevier, (2016).

[9] Tripathi A, Sharma K, Somvanshi M, Samal RL. A comparative study of clonidine and dexmedetomidine as an adjunct to bupivacaine in supraclavicular brachial plexus block. *Journal of Anaesthesiology Clinical Pharmacology*, **32**, 344–8 (2016).

[10] Azimaraghi O, Marashi SM, Khazaei N, Pourhassan S, Movafegh A. The Effect of Adding Sufentanil to 0.5% Hyperbaric Bupivacaine on Duration of Brachial Plexus Blockade in Chronic Opium Abusers: a Randomized Clinical Trial. *Anesth Pain Med*, **5**, e21960 (2015).

[11] Hanumansetty K, Hemalatha S, Gurudatt CL. Effect of dexamethasone as an adjuvant to 0.5% levobupivacaine in supraclavicular brachial plexus block for upper extremity surgeries. *International Journal of Research in Medical Sciences*, **5(5)**, 1943 – 47 (2017)

[12] Foster RH, Markham A. Levobupivacaine: a review of its pharmacology and use as a local anaesthetic. *Drugs*, **59**, 551–79 (2000).

[13] Huang YF, Pryor ME, Mather LE, Veering BT. Cardiovascular and central nervous system effects of intravenous levobupivacaine and bupivacaine in sheep. *Anesth Analg*, **86**, 797–804 (1998).

[14] Cox CR, Checketts MR, Mackenzie N, Scott NB, Bannister J. Comparison of S(-)-bupivacaine with racemic (RS)-bupivacaine in supraclavicular brachial plexus block. *Br J Anaesth*, **80**, 594–8 (1998).

[15] Pani N, Routray SS, Mishra D, Pradhan BK, Mohapatra BP, Swain D. A clinical comparison between 0.5% levobupivacaine and 0.5% levobupivacaine with dexamethasone 8 mg combination in brachial plexus block by the supraclavicular approach. *Indian J Anaesth*, **61**, 302–7 (2017).

[16] Attardi B, Takimoto K, Gealy R, Severns C, Levitan ES. Glucocorticoid induced up-regulation of a pituitary K+ channel mRNA in vitro and in vivo. *Recept Channels*, **1**, 287–93 (1993).

[17] Persec J, Persec Z, Kopljar M, Zupcic M, Sakic L, Zrinjscak IK, Marinic DK. Low-dose dexamethasone with levobupivacaine improves analgesia after supraclavicular brachial plexus blockade. *Int Orthop* **38**, 101-5. (2014).