European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 10, Issue 2, Winter 2023

ORIGINAL RESEARCH

A STUDY TO EVALUATE EFFICACY OF DEXMEDETOMIDINE AND FENTANYL AS AN ADJUVANT TO 0.5% BUPIVACAINE FOR PERIPHERAL NERVE BLOCK

Dr. Madiha Mehmood Ansari[1] Dr. Tejinder Singh[2] Anil Kori[3] Dr. Amit Jain[4] Dr. Aditya Agarwal[5] Dr. Mahima Batra[6]

[1]PG 3rd year, [2]Assistant Professor, [3]Assistant Professor,[4]Senior Resident [5]Professor and Head, [6]Professor, Department of Anaesthesia, People's College of Medical Science and Research Center, Bhopal

Corresponding Author

Dr. Amit Jain

Senior Resident,Department of Anaesthesia, People's College of Medical Science and Research Center, Bhopal

Received: 20 Febuary, 2023 Accepted: 02 March, 2023

ABSTRACT

Introduction: There are limited data available on comparing dexmedetomidine and fentanyl as adjuvant to Bupivacaine in brachial plexus block. Considering the low side effect and excellent postoperative analgesic efficacy of two drugs, it is essential to carry out a comparative evaluation of two drugs for their use with bupivacaine as adjuvant in patients undergoing upper limb surgeries which require supraclavicular brachial plexus block. Thus, the present work has been undertaken to study and compare the effect provided by dexmedetomidine and fentanyl as adjuvants to bupivacaine in supraclavicular block.

Material and Methods: 90 patients were divided into three groups; Group C (n=30): 0.5% bupivacaine hydrochloride 30ml, Group D (n=30): 0.5% bupivacaine hydrochloride 30ml and 1mcg/kg dexmedetomidine and Group F (n=30): 0.5% bupivacaine hydrochloride 30ml and 1mcg/kg fentanyl. After completion of injection; parameters (HR, RR, SBP, DBP, MAP, SpO2) were noted. Statistical analysis was performed using SPSS version 22.0 IBM. Parametric data was analysed using student t-test.

Results: Heart rates were similarly maintained in all the three groups across the time points as revealed by the insignificant p value at all the time points (p>0.05). Mean arterial pressure (MAP) was similarly maintained in all the three groups across the time points as revealed by the insignificant p value at all the time points (p>0.05). One incident of bradycardia was noted in Group F which was managed by giving Inj. Atropine 0.6mg; One patient complained of Dry mouth in Group D; One incidence of nausea was seen in Control group and Group F. Other side effects like hypotension, sedation, or itching were not noted in any of the groups in the present study.

Conclusion: The study showed no significant difference in heart rate and mean arterial pressure or any incidence of significant side effects seen with Fentanyl and Dexmeditomidine groups. Thus, we conclude that Dexmedetomidine is better than Fentanyl when added to Bupivacaine or Bupivacaine alone for use in nerve stimulator guided supraclavicular brachial plexus block without any significant complications.

Keywords: Bupivacaine; Dexmeditomidine, Fentanyl

INTRODUCTION

Regional nerve blockade avoids the unwanted effects of anaesthetic drugs used during general anaesthesia and is beneficial for the patients with various cardiorespiratory comorbidities. In supraclavicular approach, the plexus is blocked at the level of the nerve trunks where it is most compactly arranged; as a result, rapid onset of block can be achieved. To extend the duration of the block and postoperative analgesia, a number of adjuvants have been added to local anaesthetics, including opioids, benzodiazepines, magnesium sulphate, dexamethasone, alpha 2 agonists, and neostigmine.[1]

Opiates are widely known to have an analgesic effect at the central and spinal cord level. However, opioid analgesia can be initiated by activation of peripheral opioid receptors. Opioids such as fentanyl have been used for regional nerve plexus blocks to improve the block duration and quality.[2] The peripheral administration of opioids provides stronger and longer lasting analgesia without systemic side effects.[3,4] However, there are limited data available on comparing dexmedetomidine and fentanyl as adjuvant to Bupivacaine in brachial plexus block. Considering the low side effect and excellent postoperative analgesic efficacy of two drugs, it is essential to carry out a comparative evaluation of two drugs for their use with bupivacaine as adjuvant in patients undergoing upper limb surgeries which require supraclavicular brachial plexus block. Thus, the present work has been undertaken to study and compare the effect provided by dexmedetomidine and fentanyl as adjuvants to bupivacaine in supraclavicular block.

MATERIAL AND METHODS

The present prospective, randomized control study was carried out in the department of Anaesthesia, People's hospital associated with People's College of Medical Sciences & Research Centre. After approval by institutional ethical committee and written informed consent, 90 patients of ASA grade 1 and 2 posted for elective upper limb surgeries that require PNS guided supraclavicular brachial plexus block.

Inclusion criteria consisted of patients aged 18 years - 60 years, ASA grade 1 and 2 and patients who were scheduled for elective upper limb surgeries under supraclavicular brachial plexus block. Exclusion criteria comprised of patient's who did not provided consent for the study, aged <18years and >60years, ASA grade 3 and more, who had history of serious pulmonary disease, ischemic heart disease, renal/hepatic dysfunction, coronary artery, or cervical spine disease and patients with abnormal coagulation profile, patient with h/o opioid abuse, patients with local skin site infections, patients with hypersensitivity to any of the drugs used, pregnant and lactating mothers, failure of block and restricted neck movement.

90 patients were divided into three groups; Group C (n=30): 0.5% bupivacaine hydrochloride 30ml, Group D (n=30): 0.5% bupivacaine hydrochloride 30ml and 1mcg/kg dexmedetomidine and Group F (n=30): 0.5% bupivacaine hydrochloride 30ml and 1mcg/kg fentanyl.

After taking consent for study protocol patient was registered for study. Data was collected by an independent person and entered in the attached patient proforma and finally entered in the master chart attached. A systemic examination was done a day prior to surgery to rule out any of the above mentioned exclusion criteria. The cardiovascular parameters were noted. In the operation theatre, intravenous line, pulse oximeter, electrocardiograph and a noninvasive blood pressure monitor was attached. Patients were premedicated with Inj. Ondansetron 0.06mg/kg, Inj. Ranitidine 0.8mg/kg. Supraclavicular block was given using nerve stimulator to the patients; Group C received Inj. bupivacaine hydrochloride 0.5% 30 ml, Group D

received Inj. bupivacaine hydrochloride 0.5% 30ml with 1µg/kg Inj. Dexmedetomidine and Group F received Inj. bupivacaine hydrochloride 0.5% 30 ml with 1µg/kg Inj. Fentanyl. After completion of injection; parameters (HR, RR, SBP, DBP, MAP, SpO2) were noted.
Statistical analysis was performed using Statistical Package for Social Sciences® software (SPSS) version 22.0 IBM. Parametric data was analysed using student t-test. Non-parametric data was analysed using Mann Whitney 'U' test and Repeated measureof ANOVA.

RESULTS

Table 1: Sex distribution

			Group			Total	P value
			C	D	F		
Sex	Female	Count	10	9	8	27	0.853
		%	33.3%	30.0%	26.7%	30.0%	
	Male	Count	20	21	22	63	
		%	66.7%	70.0%	73.3%	70.0%	

No significant difference in terms of sex distribution was obtained between all the 3groups as revealed by the insignificant p value of 0.853 (table 1).

Table 2: Heart rate trends (beats per min)

HR	Groups						P value
	C		D		F		
	Mean	SD	Mean	SD	Mean	SD	
Baseline	83.53	10.355	83.87	6.663	81.20	10.682	0.492
Immediatelyafter Block	83.93	9.329	82.80	6.509	83.73	10.670	0.847
5 min	83.13	9.243	85.03	7.568	82.20	10.443	0.478
10 min	82.07	9.461	83.93	8.229	81.07	10.208	0.485
15 min	81.40	8.822	80.80	7.194	80.00	9.882	0.823
20 min	81.00	7.944	79.87	6.235	80.20	9.026	0.847
25 min	80.40	7.266	79.47	6.033	79.73	8.317	0.877
30 min	80.87	7.021	78.33	5.683	78.47	8.182	0.297
60 min	80.20	7.599	78.07	6.091	77.73	7.978	0.366
90 min	80.47	7.060	78.00	6.170	78.13	7.219	0.295
120 min	81.33	7.471	78.60	6.173	78.27	7.768	0.198
240 min	82.13	7.718	79.80	6.713	79.20	7.976	0.282
360 min	83.73	6.617	80.87	7.291	79.33	8.507	0.076

Heart rates were similarly maintained in all the three groups across the time points as revealed by the insignificant p value at all the time points ($p>0.05$) (table 2, graph 1).

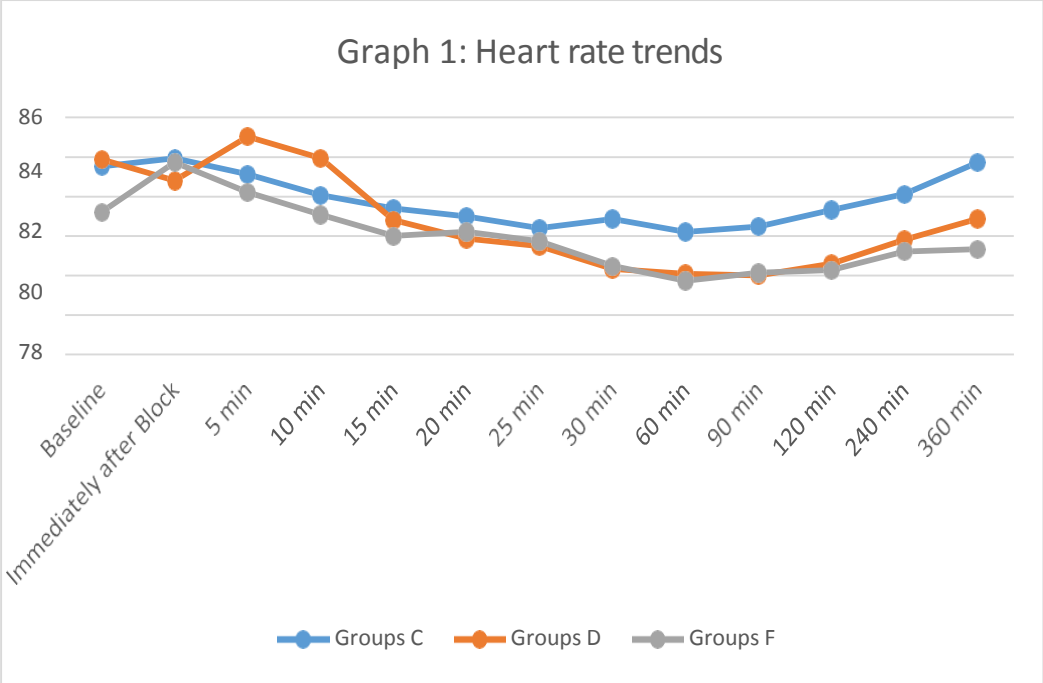

Table 3: Mean arterial pressure (MAP) trends (mmHg)

MAP	Groups						P value
	C		D		F		
	Mean	SD	Mean	SD	Mean	SD	
Baseline	92.67	6.498	94.20	5.997	94.47	10.517	0.639
Immediatelyafter Block	93.80	6.048	95.10	7.102	95.17	9.318	0.736
5 min	93.17	5.534	95.30	6.939	95.23	7.445	0.377
10 min	93.37	5.875	95.90	5.148	95.70	6.904	0.199
15 min	93.10	6.228	95.77	5.456	95.70	6.808	0.170
20 min	92.63	6.156	95.87	5.151	94.97	6.578	0.104
25 min	92.40	5.928	95.60	5.076	94.53	6.339	0.100
30 min	92.73	5.546	95.13	4.911	94.10	7.150	0.297
60 min	92.50	5.829	94.43	5.386	94.43	6.452	0.347
90 min	92.43	5.482	94.60	4.917	94.20	6.020	0.272
120 min	93.13	5.104	95.00	4.799	94.70	5.516	0.325
240 min	93.80	5.195	95.37	4.582	95.53	6.241	0.392
360 min	94.40	5.506	96.73	4.234	96.23	6.826	0.244

Mean arterial pressure (MAP) was similarly maintained in all the three groups acrossthe time points as revealed by the insignificant p value at all the time points (p>0.05).

Table 4: Comparing side effects

Side Effect	Group			Total
	C	D	F	
Bradycardia	nil	nil	1	1
Hypotension	nil	nil	nil	0
Dry Mouth	nil	1	nil	1
Sedation	nil	nil	nil	0
Nausea	1	nil	1	2
Itching	nil	nil	nil	0

One incident of bradycardia was noted in Group F which was managed by giving Inj. Atropine 0.6mg; One patient complained of Dry mouth in Group D; One incidence of nausea was seen in Control group and Group F. Other side effects like hypotension, sedation, or itching were not noted in any of the groups in the present study (table 5).

DISCUSSION

In current anesthesia practice Anesthesiologists are commonly employing peripheral nerve block, sub-arachnoid block, epidural and other nerve blocks to avoid the risks associated with general anesthesia as well as for postoperative analgesia for a wide variety of procedures. Supraclavicular brachial plexus block is one of the most commonly used blocks for procedure involving the upper extremities.

The selection of the optimal long-acting local anesthetic and its concentration for supraclavicular brachial plexus block has always been debated. The criteria is to choosea local anesthetic that provides the best possible decrease in time of onset as well as to enhance duration of action and prolong the postoperative pain free period that is clinically useful to reduce analgesic requirements.

Bupivacaine has been used with various adjuvants, however recently it has been used more commonly with alpha 2 adrenergic receptor agonist dexmedetomidine and opioid fentanyl. Opioid receptors have been targeted for the treatment of pain and related disorders for thousands of years and remain the most widely used analgesic.[5] Fentanyl binds to opioid receptors, especially the mu opioid receptor, which is coupled to G-proteins. Activation of opioid receptor causes GTP to be exchanged for GDP on the G-proteins which in turn down regulates adenylate cyclase, reducing concentrations of cAMP.[6] Reduced cAMP decreases cAMP dependent influx of calcium ions into the cell.[5,7] This results in hyperpolarization of the cell membrane and inhibition of nerve activity.[5,8]

Dexmedetomidine is a centrally acting α2 agonist mediating antinociception via peripheral α2 adrenoceptors. The activation of inwardly rectifying G1 protein-gated potassium channels, resulting in membrane hyperpolarization and decrease in the excitability of the CNS cells and the reduction of calcium conductance into the cells, inhibiting neurotransmitter release, are the probable mechanisms of action of dexmedetomidine.[9,10]

No significant difference in terms of sex distribution was obtained between all the 3 groups as revealed by the insignificant p value of 0.853. Heart rates and mean arterial pressure were

similarly maintained in all the three groups across the time points as revealed by the insignificant p value at all the time points ($p>0.05$). This highlights that all the baseline characteristic between the groups were similar highlighting no effects of these baseline parameters on the outcomeof the study drugs.

We recorded one incidence of bradycardia in Fentanyl group, one incidence of dry mouth in Dexmedetomidine group, nausea was recorded once in Control group and once in Fentanyl group. In agreement to present study, Hamed et al (2018) reported nausea and vomiting with fentanyl.[1] However, no episode of hypotension, respiratory depression, or dizziness was reported by Bharti et al (2015).[11,12]

Limitation of this study was the dose selection was based on previous studies where dexmedetomidine 1 mcg/kg and fentanyl 1mcg/kg added to local anesthetic were used in supraclavicular brachial plexus block. A lesser concentration of dexmedetomidine and fentanyl may be useful to prolong the block with adequate anesthesia. This in turn may be beneficial in high-risk patients.

CONCLUSION

The study showed no significant difference in heart rate and mean arterial pressure or any incidence of significant side effects seen with Fentanyl and Dexmeditomidine groups. Thus, we conclude that Dexmedetomidine is better than Fentanyl when added to Bupivacaine or Bupivacaine alone for use in nerve stimulator guided supraclavicular brachial plexus block without any significant complications.

REFERENCES

1. Hamed MA, Ghaber S, Reda A. Dexmedetomidine and Fentanyl as an Adjunct to Bupivacaine 0.5% in Supraclavicular Nerve Block: A Randomized Controlled Study. *Anesth Essays Res*. 2018;12(2):475-479.
2. Nishikawa K, Kanaya N, Nakayama M, Igarashi M, Tsunoda K, Namiki A. Fentanyl improves analgesia but prolongs the onset of axillary brachial plexus block by peripheral mechanism. Anesth Analg. 2000;91:384-7.
3. Chavan SG, Koshire AR, Panbude P. Effect of addition of fentanyl to local anesthetic in brachial plexus block on duration of analgesia. Anesth Essays Res.2011;5:39–42.
4. Kardas K, Schools A, Concepcion M. Effect of brachial plexus fentanyl on supraclavicular block. A randomized, double-blind study. Regional Anaesthesia 1996; 20(4): 311-5.
5. Al-Hasani R, Bruchas MR: Molecular mechanisms of opioid receptor-dependent signaling and behavior. Anesthesiology. 2011 Dec;115(6):1363-81.
6. Stein C. Peripheral mechanisms of opioid analgesia. Anesth Analg. 1993;76:182-91.
7. Kaniyil S, Radhakrishnan P. Does fentanyl prolong the analgesia of local anesthetics in brachial plexus block? A randomized controlled study. Int J Res MedSci. 2017; 5 :583–7.
8. Gissen AJ, Gugino LD, Datta S, Miller J, Covino BG. Effects of fentanyl and sufentanil on peripheral mammalian nerves. Anesth Analg. 1987;66(12):1272-6.
9. Swami SS, Keniya VM, Ladi SD, Rao R. Comparison of dexmedetomidine and clonidine (α2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: A randomised double-blind prospective study. Indian J Anaesth. 2012 May;56(3):243-9. doi: 10.4103/0019-5049.98767. PMID: 22923822; PMCID: PMC3425283.

10. Abdallah FW, Brull R. Facilitatory effects of perineural dexmedetomidine on neuraxial and peripheral nerve block: A systematic review and meta-analysis. BrJ Anaesth. 2013; 110 :915–25.
11. Bharti N, Sardana DK, Bala I. The analgesic efficacy of dexmedetomidine as an adjunct to local anesthetics in supraclavicular brachial plexus block: A randomized controlled trial. Anesth Analg. 2015; 121 :1655–60
12. Manohar P, Prakash M. Comparison of the effects of fentanyl and dexmedetomidine in supraclavicular brachial plexus block achieved with 0.5%bupivacaine. JMSCR. 2015; 3 :7131–8.