International Journal Dental and Medical Sciences Research
Volume 2, Issue 5, pp: 174-180 www.ijdmsrjournal.com ISSN: 2582-6018

A Comparative Study of Haemodynamic Changes on adding Dexmedetomidine and Dexamethasone to Local Anaesthetics in Brachial Plexus Block

Raj Kumar Choubey[1], Kirti Bhushan[2], ManishHonwad[3], Sachin Narayan Kulkarni[4], Geetanjali Singh[5], Rahul Yadav[6]

[1] *Assistant Professor (Anaesthesiology), Heritage Institute Of Medical Science, Varanasi, India*
[2] *Specialist (Anaesthesiology), Tata Main Hospital (TMH), Bistupur, Jamshedpur, India*
[3] *Commanding Officer & Professor (Anaesthesiology), INHS Sanjivani, Naval Base, Kochi, India*
[4] *Professor (Anaesthesiology), Dept of Anaesthesiology & Critical Care, INHS Asvini, Mumbai, India*
[5] *Consultant (Ophthalmology), Manav Welfare Trust & Eye Hospital, Mumbai, India*
[6] *Professor (Anaesthesiology &Neuroanaesthesiology), Dept of Anaesthesiology & Critical Care, INHS Asvini, Mumbai, India*
[*] *Corresponding Author:Dr Geetanjali Singh*

Date of Submission: 15-10-2020 Date of Acceptance: 02-11-2020

ABSTRACT:Background: Brachial Plexus Block (BPB) offers an excellent operative field for surgeries of the upper extremities. One of the common approaches to blockade of brachial plexus is the supraclavicular approach as it has a favorable safety profile, ease of performance, high patient acceptability and broad applicability for hand, wrist and forearm procedures.

Materials and Methods: This prospective randomized observational study was conducted to evaluate the variation of haemodynamic parameters on adding dexmedetomidine and dexamethasone to local anaesthetics in supraclavicular brachial plexus block under ultrasound guidance. A total of sixty patients of ASA I-II scheduled for upper extremity surgery were randomly allocated to either of the two groups:

Group A: 10ml 2% Lignocaine with adrenaline, 20ml 0.5% Bupivacaine, 30 mcg Dexmedetomidine and 0.9% normal saline(NS) to make 30 ml volume

Group B: 10ml 2% Lignocaine with adrenaline, 20ml 0.5% Bupivacaine, 8 mg Dexamethasone and 0.9% normal saline(NS) to make 30 ml volume.

Results: In our study, no significant variation in hemodynamic and respiratory parameters was observed at different intervals of time as compared to the baseline in either of the two groups.

Conclusion: The addition of Dexmedetomidine and Dexamethasone as adjuvants to local anesthetic for brachial plexus block is a safe practice which doesn't lead to significant haemodynamic perturbations or adverse clinical outcomes.

KEYWORDS: Bupivacaine, Dexmedetomidine, Dexamethasone, Supraclavicularbrachial plexus block

I. INTRODUCTION

The treatment of surgical anesthesia and analgesia using various modalities such as systemic opioids, cyclooxygenase inhibitors, patient-controlled analgesia, transcutaneous electrical nerve stimulation, and continuous central and peripheral nerve block (PNB)etc., has made rapid strides in the last few decades. Despite these technical advancements, many patients continue to suffer from poor pain management, the key reasons which include insufficient awareness of successful dosing and opioid therapy due to fear of respiratory depression and addiction.[1] Rapid onset, predictabledense anesthesia, and postoperative analgesia are common features of PNB. PNB is accomplished by injecting a local anesthetic solution around a nerve root to produce anesthesia without any distortion of the surgical anatomy in the distribution of that nerve.[2] Compared to General Anaesthesia (GA), the benefits of a single shot PNB are many: profound muscle relaxation and analgesia, early ambulation,avoidance of intubation, and fewer systemic as well as post-operative side effects.[3,4] Brachial plexus block (BPB) is one of the most widely practiced blocks. The brachial plexus may be anesthetized either above the clavicle (interscalene and supraclavicular approaches) or below the clavicle (infraclavicular and axillary approaches). The supraclavicular approach is one of the common approaches to

International Journal Dental and Medical Sciences Research
Volume 2, Issue 5, pp: 174-180 www.ijdmsrjournal.com ISSN: 2582-6018

brachial plexus blockade, as it has a favorable safety profile, ease of performance, better patient acceptability, and wide applicability for hand, wrist, and forearm procedures.[2,5]

For the purpose of improving analgesic effectiveness and increasing the duration of analgesia, numerous opioids as well as other medications have been used as adjuvants with local anesthetics.[6-8] With the advent of electronic devices and imaging technology, many improvements have been made to the brachial plexus block technique, which is primarily intended to achieve a predictable, effective and satisfactory block; while minimising the risk of complications associated with blind technique. The implementation of the nerve stimulator to locate the brachial plexus before anesthetic agents are injected is one such up-gradation.

II. MATERIALS AND METHODS

The presentprospective randomized observationalstudy was conducted in the Department of Anaesthesiology and Critical Care of a tertiary care hospital at Mumbai over a period of eighteen months. After approval from institutional ethics committee and obtaining written informed consent, sixtypatients of either sex between the age group of 18 and 80 years and weighing at least 50 kg, belonging to the American Society of Anaesthesiologists physical status classification I and II, scheduled to undergo elective upper limb surgeries (elbow, forearm, wrist and hand) were enrolled in the study. Patients with pre-existing coagulopathy and/or neuropathy; with history of allergy to the study drugs or local anaesthetics, and significant co-morbidities (ASA physical status III and above) were excluded from the study. Post randomization by drawing of the labelled cards (A and B) from a sealed opaque envelope, the patients were divided into two groups of 30 participabts each as follows:

Group A: 10ml 2% Lignocaine with adrenaline, 20ml 0.5% Bupivacaine, 30 mcg Dexmedetomidine and 0.9% normal saline (NS) to make 30 ml volume

Group B: 10ml 2% Lignocaine with adrenaline, 20ml 0.5% Bupivacaine, 8 mg Dexamethasone and 0.9% normal saline (NS) to make 30 ml volume.

Once enrolled in the study, patients were explained about the entire procedure to their complete satisfaction. All patients received premedication on the night before surgery as per the institutional protocol, and were kept nil per oral as per the standard fasting guidelines. Once inside the operation theatre, standard monitoring in form of non-invasive blood pressure (NIBP), oxygen saturation (SpO_2) and ECG was initiated, and the baseline value of each parameter was recorded.

The ultrasound guided in-plane supraclavicular approach to the brachial plexus was adopted for administering the block. Following completion of the LA injection, time was noted (Time-0) and thefollowing parameters were recorded:pulse rate, systolic blood pressure(SBP), diastolic blood pressure(DBP), mean arterial pressure(MAP), respiratory rate (RR) and SpO_2 were recorded at an interval of every 2 minutes (min) from Time-0 for the initial 60 min and thereafter at an interval of every 5 min till the end of surgery.Aftercompletion of the surgery, the patient was shifted to the post-operative recovery ward and monitored until the complete recession of sensory as well as motor block. All the above mentioned parameters were recorded at hourly interval in the postoperative period.

Statistical Analysis:

Data collected on the preformed questionnaire was entered in the excel sheet and analysis of the data was done using the SPSS 16.0 package and primer software. The comparison of quantitative variables between and within the groups was done using the student's t-test, while the qualitative data was compared using the chi-square test. The confidence limit for significance was fixed at a 95% level with a p-value < 0.05.

III. RESULTS

Demographic Data

The mean age among the groups was similar and comparable i.e. 38.67 ± 15.62 and 42.33 ± 18.33 years respectively (**Table 1**). The male/female ratio was3:1inthe groups and the majority of patients were male in both the groups (**Table 2**).

Table 1: Comparison of Group A (Dexmed) and Group B (Dexa) according to age

Group	Group A (Dexmed)	Group B (Dexa)
Mean ± SD	42.33 ± 18.33	38.67 ± 15.62
p value	0.408	
Difference	Non-significant	

International Journal Dental and Medical Sciences Research
Volume 2, Issue 5, pp: 174-180 www.ijdmsrjournal.com ISSN: 2582-6018

Table 2: Distribution of study participants as per sex

Group	Total No. of patients	Male		Female	
		n	%	n	%
Dexmed	30	23	76.7	7	23.3
Dexa	30	22	73.3	8	26.7
Total	60	45	75	15	25

The mean weight of patients in group dexa was 60.87 ± 7.37 kg and group dexmed was 64.47 ± 10.8 kg (**Table 3**). The majority of the patients (46.7%) were within the height range of 171-180 cm (**Table 4**). No significant difference was seen between the two groups in terms of mean body weight and height.

Table 3: Comparison of mean body weight

Groups	Group A(Dexmed)	GroupB (Dexa)
Mean ± SD	64.47 ± 10.8	60.87 ± 7.371
Unpaired t test/ t value	1.508	
p value	0.137	
Difference	Non-significant	

Table 4: Comparison of height between two groups

Groups	Group A (Dexmed)	GroupB (Dexa)
Mean ± SD	166.5 ± 10.81	166.1 ± 10.11
Unpaired t test/ t value	0.16	
p value	0.873	
Difference	Non-significant	

Haemodynamic Changes

There was no statistically significant difference between the two groups in terms of pulse rate, SBP, DBP, MAP, RR and SpO_2 at any point of time (Tables **6, 7, 8, 9, 10** and **11**).

Table 6: Comparison of pulse rate between two groups

Pulse Rate	Group A (Dexmed)	Group B (Dexa)	Unpaired t test	p value
	Mean ± SD	Mean ± SD		
Baseline	88.87 ±12.92	85.33 ± 10.6	1.158	0.252
2 min	89.1 ± 12.86	84.63 ± 10.02	1.5	0.139
4 min	88.7 ± 12.58	85.13 ± 10.6	1.18	0.24
6 min	88.63 ±12.68	84.77 ± 12.41	1.194	0.237
8 min	87.33 ±12.37	83.17 ± 11.84	1.33	0.19
10 min	87.1± 13.8	82.43 ± 11.19	1.438	0.156
20 min	85.83±12.52	79.9 ± 13.63	1.76	0.084
30 min	84.7 ± 11.38	80.53 ± 11.58	1.405	0.165
40 min	82.4 ± 12	78.9 ± 11.99	1.13	0.26
50 min	81.21± 12.33	78.77 ± 11.77	0.77	0.441
60 min	80.63 ± 12.53	78.45 ± 11.67	0.675	0.503

International Journal Dental and Medical Sciences Research
Volume 2, Issue 5, pp: 174-180 www.ijdmsrjournal.com ISSN: 2582-6018

90 min	80.12 ±12.32	77.25 ± 12.28	0.707	0.484
120 min	81 ± 10.37	78.62 ± 12.25	0.498	0.626
1 hour after surgery	82.6 ± 10.79	78.47 ± 12.18	1.39	0.169
4 hour after surgery	83.27 ± 10.24	78.9 ± 11.8	1.5	0.132

Table 7: Comparison of Systolic Blood Pressure between between two groups

SBP mmHg	**Group A(Dexmed)**		**Group B (Dexa)**		**Unpaired t test**	**p value**
	mean	**SD**	**Mean**	**SD**		
Baseline	135.7	18.94	134	16.6	0.37	0.713
0 min	138.7	19.6	134.6	19.15	0.805	0.424
2 min	137.2	19.47	135.1	17.96	0.434	0.666
4 min	135.1	16.53	133.7	15.94	0.318	0.752
6 min	134	16	132.1	14.34	0.484	0.63
8 min	135.3	18.89	133.3	16.89	0.432	0.667
10 min	133.6	17.25	131.8	14.32	0.456	0.65
20 min	132.8	16.86	131.1	14.62	0.417	0.678
30 min	132.2	16.88	130.8	13.94	0.359	0.721
40 min	132.3	16.4	131.7	15.79	0.144	0.886
50 min	131.4	15.97	129.9	13.47	0.395	0.694
60 min	130.8	16.71	128.3	13.42	0.629	0.532
90 min	130.5	17.91	129.8	13.5	0.141	0.889
120 min	126	15.83	126.5	8.799	0.78	0.94
1 hour after surgery	132.8	15.79	129.8	14.84	0.75	0.456
4 hour after surgery	133.9	16.03	130.2	13.4	0.97	0.34

Table 8: Comparison of Diastolic Blood Pressure between between two groups

DBP	**Group A (Dexmed)**		**Group B (Dexa)**		**Unpaired t test**	**p value**
	mean	**SD**	**Mean**	**SD**		
Baseline	85.17	11.65	81	13.1	1.229	0.199
0 min	85.03	11.38	82.33	10.32	.962	0.34
2 min	85.067	12.4	84.1	9.69	0.336	0.738
4 min	83.467	11.27	82.33	9.33	0.424	0.673
6 min	84.6	11.388	80.03	10.99	1.58	0.119
8 min	83.267	18.54	77.466	17.88	1.233	0.222
10 min	83.97	12.43	79.93	12.179	1.269	0.209
20 min	83.667	12.53	80.1667	12.323	1.091	0.280
30 min	83.03	10.93	77.4	12.26	1.878	0.065
40 min	82.46	11.89	79.433	12.27	0.972	0.335
50 min	82.53	10.91	79.3	11.45	1.1	0.276
60 min	79.52	9.59	78.10	10.79	0.517	0.607
90 min	82.294	13.4	80	11.04	0.571	0.572
120 min	85.7	14.04	84.5	9.165	0.201	.844
1 hour after surgery	83.2	11.53	79.567	11.59	1.217	0.229
4 hour after surgery	81.93	12.24	80.8	9.03	0.208	0.685

International Journal Dental and Medical Sciences Research
Volume 2, Issue 5, pp: 174-180 www.ijdmsrjournal.com ISSN: 2582-6018

Table 9: Comparison of Mean Arterial Pressure between between two groups

MAP	Group A (Dexmed)		Group B (Dexa)		Unpaired t test	p value
	mean	SD	Mean	SD		
Baseline	98.76	11.38	96.73	10.86	0.708	0.482
0 min	99.63	10.13	97.41	10.05	0.844	0.402
2 min	100.07	11.07	99.26	10.6	0.286	0.776
4 min	98	9.84	97.4	9.37	0.242	0.810
6 min	99.33	10.32	95.8	9.59	1.373	0.175
8 min	98.9	10.74	96.73	11.03	0.771	0.444
10 min	97.13	11.72	96.167	9.8	0.346	0.73
20 min	96.83	11.08	95.00	9.78	0.679	0.5
30 min	96.06	9.49	93.43	10.32	1.028	0.308
40 min	95.76	10.82	94.73	9.1	0.4	0.691
50 min	96.14	10.33	94.86	8.63	0.512	0.611
60 min	96.25	9.07	93.58	8.41	1.144	0.258
90 min	95.529	11.76	94.85	8.95	0.199	0.843
120 min	98.14	13.1	96	10	0.359	0.725
1 hour after surgery	98.5	10.57	94	10.61	1.645	0.105
4 hour after surgery	97.67	10.17	95.33	8.46	0.965	0.338

Table 10: Comparison of Respiratory Rate between two groups

Respiratory Rate	Group A (Dexmed)		Group B (Dexa)		Unpaired t test	p value
	mean	SD	Mean	SD		
Baseline	14.4	2.32	14.8	2.15	0.69	0.49
0 min	14.6	2.4	15.1	2.35	0.814	0.419
2 min	14.5	2.4	15.03	2.29	0.824	0.413
4 min	14.5	2.345	14.9	2.39	0.653	0.516
6 min	14.3	2.27	14.7	2.29	0.678	0.5
8 min	14.33	2.32	14.7	2.18	0.687	0.495
10 min	14.3	2.38	14.8	2.26	0.77	0.44
20 min	14.06	2.22	14.4	2.22	0.58	0.65
30 min	14.3	2.26	14.6	2.14	0.586	0.56
40 min	13.8	1.45	14.46	1.38	1.824	0.073
50 min	14.07	2.17	14.4	2.02	0.595	0.554
60 min	14	3.65	14.21	2.242	0.335	0.739
90 min	14.23	2.7	14.50	2.50	0.309	0.759
120 min	14	3.65	14.75	1.48	0.535	0.602
1 hour after surgery	13.83	2.05	14.36	1.90	1.04	0.301
4 hour after surgery	14.06	2.21	14.33	2.18	0.470	0.640

Table 11: Comparison of SpO_2 between two groups

SpO_2	Group A (Dexmed)		Group B (Dexa)		Unpaired t test	p value
	mean	SD	Mean	SD		
Baseline	98.86	1.25	97.93	1.74	2.38	0.020
0 min	98.7	1.26	98.06	1.61	1.69	0.09
2 min	98.8	1.15	98.13	1.54	1.89	0.064

International Journal Dental and Medical Sciences Research
Volume 2, Issue 5, pp: 174-180 www.ijdmsrjournal.com ISSN: 2582-6018

4 min	98.86	1.25	98.1	1.68	1.99	0.05
6 min	98.8	1.18	98.06	1.65	1.96	0.054
8 min	98.76	1.25	97.93	1.76	2.11	0.039
10 min	98.7	1.53	97.96	1.77	1.71	0.09
20 min	98.56	1.43	97.83	1.74	1.78	0.08
30 min	98.33	1.49	97.83	1.78	1.17	0.244
40 min	98.43	1.59	97.76	1.73	1.55	0.126
50 min	98.57	1.28	98.00	1.59	1.49	0.141
60 min	98.22	1.62	97.86	1.66	0.819	0.417
90 min	97.7	1.44	97.95	1.57	0.488	0.629
120 min	98.85	1.21	98.37	2.06	0.540	0.599

IV.DISCUSSION

We designed this prospective randomized doubleblind study to identify the outcome of adding dexmedetomidine and dexamathasone to local anaesthetics in brachial plexus block by supraclavicular approach under ultrasound guidance.Sixty patients were randomly divided into two equal groups and haemodynamic changes; side effects and complications were compared. Premedication and anesthetic technique was kept constant to avoid variation in our observations. Since the drug solution had 20ml of 0.5% bupivacaine and 10 ml of 2% lignocaine with adrenaline 1:2,00,000 we ensured that the study did not expose patients in the lowest weight range (50-60 kg) to an unacceptably high dose of the drug.The duration of surgery was not significant among the groups. The demographic parameters between the groups in terms of gender distribution, age, weight, duration of surgery, and ASA status were comparable amongst the groups.

The basic effects of α_2 agonists on the cardiovascular system are decreased heart rate; decreased systemic vascular resistance; and indirectly decreased myocardial contractility, cardiac output, and systemic blood pressure. The biphasic hemodynamic responseto a bolus of dexmedetomidine in humans is already known. An acute IV injection of 2 µg/kg resulted in an initial increase in blood pressure (22%) and decrease in heart rate (27%) from baseline that occurred at 5 minutes after injection. This initial increase in blood pressure is probably due to the vasoconstrictive effects of dexmedetomidine on peripheral α_2 receptors. Heart rate returned to baseline by 15 minutes, and blood pressure gradually declined to approximately 15% below baseline by 1 hour. After an intramuscular injection of the same dose, the initial increase in blood pressure was not seen, and heart rate and blood pressure remained within 10% of baseline.The notable finding in our study was that no significant variation in hemodynamic and respiratory parameters was seen at different intervals of time as compared to the baseline in any of the groups; possibly because of the low dose of dexmedetomidine used. This finding was in contrast to most other studies.[9-14]

In our study, observations were also made for intraoperative side effects and complications like vessel injury, hematoma, the inadequacy of block, nausea and vomiting, dyspnea, fall in RR <10 per min, fall in SpO2 < 90%, pruritus, any symptom/sign of LA toxicity, any significant ECG changes, Horner's syndrome, sedation and others (if any). Vessel injury had occurred in only 5 (8.3%) patients but block could be performed successfully in these patients once pressure stopped the bleeding. Kothari D observed that 6% had vessel puncture using the lateral approach for supraclavicular brachial plexus block.[15] Chances of piercing the vessels are remote as they lie medial to the nerves. Dalens B et al. in the comparison between classical versus parascalene approach found a significant difference in the incidence of puncture of subclavian vessels.[16]In our study, only 3(5%) patients complained of nausea and vomiting in the postoperative period. All three patients were from group dexmed. This systemic effect indicates partial systemic resorption of the study drug. It was observed that these side effects took place during the first 6 hours. This suggests that blood levels becomelow as time elapses.

We did not include systemic administration of drugs in both the groups but previous studies where dexmedetomidine and dexamethasone were also administered systemically did not find any superiority overuse of dexmedetomidine or dexamethasone as an adjuvant with LA in peripheral nerve block, in providing postoperative analgesia. From the above, we find that dexmedetomidine and dexamethasone can be effectively used in brachial plexus block for postoperative analgesia even in daycare surgery.

V. CONCLUSION

Based on the observations from our study as outlined above, we conclude that dexmedetomidine and dexamethasone can be effectively used as adjuvants in brachial plexus block without effecting any haemodynamic compromise.

Funding
None.

Conflict of Interest
None.

REFERENCES

[1]. Hurley RW, Wu CL. Acute postoperative pain. In: Miller RD. Miller's Anesthesia: 7th ed. Philadelphia: Churchill Livingstone; 2010. P.2757-81.
[2]. Wedel DJ, Horlocker TT. Nerve Blocks. In: Miller RD. Miller's Anesthesia: 7th ed. Philadelphia:Churchill Livingstone; 2010.p.1639-74.
[3]. Pollard BJ, Norton ML. Principles of airway management. In: Wylie and Churchill Davidson's A Practice of Anesthesia: 7th ed. London: Arnold; 2003: Arnold; 2003.p. 443-64.
[4]. Mayfield JB, Rosow CE. Anesthesia for the outpatient. In: Wylie and Churchill Davidson's A Practice of Anesthesia: 7th ed. London: Arnold; 2003.p. 1021-36.
[5]. Tsui BC, Rosenquist RW. Peripheral Nerve Blockade. In: Barash PG, Cullen BF, Stoelting RK, Cahalan MK, Stock MC. Clinical Anesthesia: 6th ed. Philadelphia:Lippincott Williams & Wilkins; 2009.p.955-1004.
[6]. Khosa DS, Thind SS, Gupta HK, Jain S. Effects of adding potassium chloride to lignocaine and bupivacaine solutions on the onset time and duration of brachial plexus block. Indian Journal of Anaesthesia.1990; 38(8):119-22.
[7]. Candido KD, Franco CD, Khan MA, Winnie AP, Raja DS. Buprenorphine added to the local anesthetic for brachial plexus block to provide postoperative analgesia in outpatients. Regional Anesthesia and Pain Med. 2001; 26(4): 352-6.
[8]. Bazin JE, Massoni C, Bruelle P, Fenies V, Groslier D, Schoeffler P. The addition of opioids to local anaesthetics in brachial plexus block: the comparative effects of morphine, buprenorphine and sufentanil. Anaesthesia.1997; 52(9):858-62.
[9]. Zhang Y, Wang CS, Shi JH, et al. Perineural administration of dexmedetomidine in combination with ropivacaine prolongs axillary brachial plexus block. Int J Clin Exp Med 2014;7:680–5.
[10]. Das A, Majumdar S, Halder S, et al. Effect of dexmedetomidine as adjuvant in ropivacaine-induced supraclavicular brachial plexus block: a prospective, double-blinded and randomized controlled study. Saudi J Anaesth 2014;8(suppl 1):S72–7.
[11]. Gurajala I, Thipparampall AK, Durga P, et al. Effect of perineural dexmedetomidine on the quality of supraclavicular brachial plexus block with 0.5% ropivacaine and its interaction with general anaesthesia. Indian J Anaesth 2015;59:89–95.
[12]. Khade AR, Makwana JC, Jethva NK. Evaluation of effect of dexmeditomidine as an adjuvant to bupivacaine in supraclavicular brachial plexus block. NJIRM 2013;4:122–7.
[13]. Tiwari P, Jain M, Rastogi B. A comparative clinical study of perineural administration of 0.75% ropivacaine with and without dexmedetomidinein upper limb surgery by ultrasound guided single injection supraclavicular brachial plexus block. Glob anesthperioper Med 2015;1:131–3.
[14]. Lee MJ, Koo DJ, Choi YS, et al. Dexamethasone or dexmedetomidine as local anesthetic adjuvants for ultrasound-guided axillary brachial plexus blocks with nerve stimulation. Korean J Pain 2016;29:29–33.
[15]. Kothari D. Supraclavicular brachial plexus block: A new approach. Indian J. Anaesth. 2003; 47(4): 287-8.
[16]. Dalens B, Vanneuville G, Tanguy A. A new parascalene approach to the brachial plexus in children: Comparison with the supraclavicular approach. Anesthanalg. 1987; 66(12):1264-71.